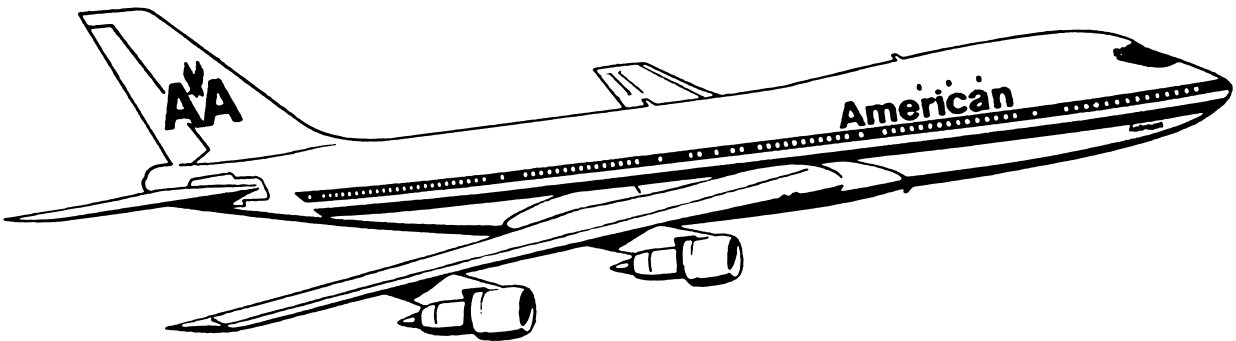


B-747



SYSTEMS REVIEW

American Airlines Flying Training Division 1978

CONTENTS

	Page
PREFACE	
SECTION I – GENERAL	
DESCRIPTIONS	1-1
DEFINITIONS	1-10
SECTION II – SYSTEMS	
EMERGENCY EQUIPMENT	2-1
AIR-CONDITIONING PNEUMATICS & PRESSURIZATION	2-5
ANTI-ICING & RAIN PROTECTION	2-9
AUTO FLIGHT	2-12
APU	2-15
COMMUNICATIONS	2-16
ELECTRICAL	2-17
FIRE PROTECTION	2-23
FLIGHT CONTROLS	2-26
FLIGHT INSTRUMENTS	2-27
FUEL	2-28
HYDRAULICS	2-30
LANDING GEAR	2-31
MISCELLANEOUS	2-32
NAVIGATION	2-33
POWERPLANT	2-34
RADAR	2-37
OXYGEN	2-37
SECTION III – COCKPIT PANEL DESCRIPTION	
CAPTAINS INSTRUMENT PANEL	3-1
CENTER INSTRUMENT PANEL	3-10
F/O INSTRUMENT PANEL	3-15
NAVIGATION AND AUTO FLIGHT PANEL	3-17
OVERHEAD PANEL	3-20
PILOTS CONTROL STAND	3-30
– FORWARD ELECTRONICS PANEL	3-31
– PEDESTAL	3-34
– AFT ELECTRONICS PANEL	3-35
FLIGHT ENGINEER'S PANEL	3-39
MISCELLANEOUS	3-71
FREIGHTER DIFFERENCES	3-72

PREFACE

This manual is designed for use by crewmembers prior to and during 747 training at the Flight Academy. If differences exist between this manual and the Operating Manual, the Operating Manual will take precedence in all instances.

This introduction contains general information and a brief description of systems and cockpit controls and indications on the passenger version of the B-747. Where freighter differences occur they will be discussed at the end of each chapter.

Section I contains a general description of the 747 airplane and definitions used in training and operation.

Section II briefly describes the systems.

Section III identifies and describes cockpit controls and indications.

Detailed description, limitations and operating procedures have been avoided. This type of information will be provided in the formal training program and the Operating Manual.

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SECTION I - GENERAL

DESCRIPTION

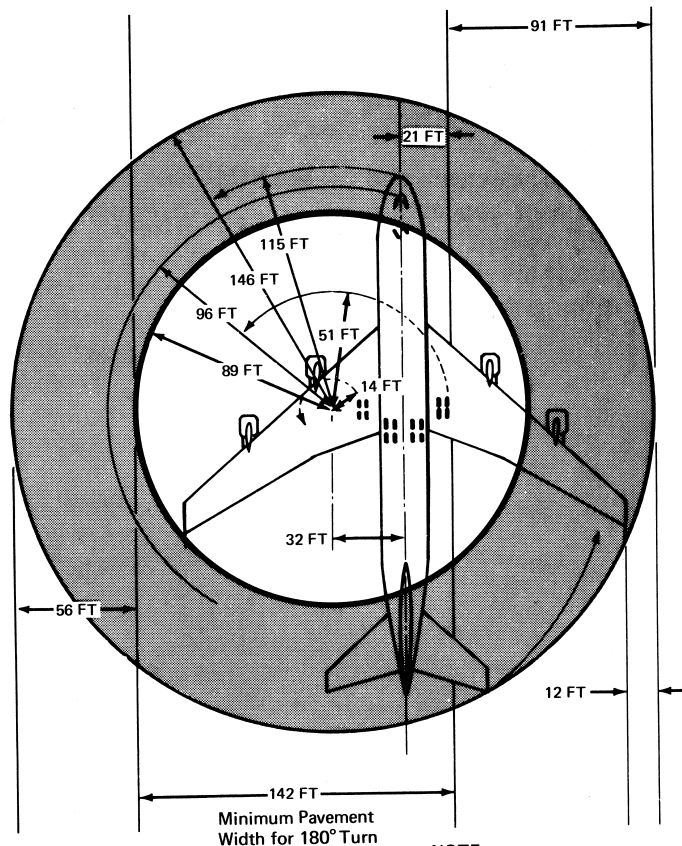
American Airlines operates both the passenger and freighter versions of the B-747. Exterior appearance of both aircraft are almost identical except for the large main deck cargo door on the left aft side of the freighter. Exterior dimensions, turning radius, etc., are the same for both models.

MAXIMUMS	PASSENGER	FREIGHTER
Take-Off Weight	710,000 lbs.	734,000 lbs.
Landing Weight	564,000 lbs.	585,000 lbs.
Fuel Weight	315,000 lbs.	315,000 lbs.

American Airlines' B-747's are equipped with four Pratt & Whitney JT9D-3A or JT9D-7AH engines.

	-3A	-7AH
Approximate Thrust Rating	43,500	45,000

TURNING CLEARANCE

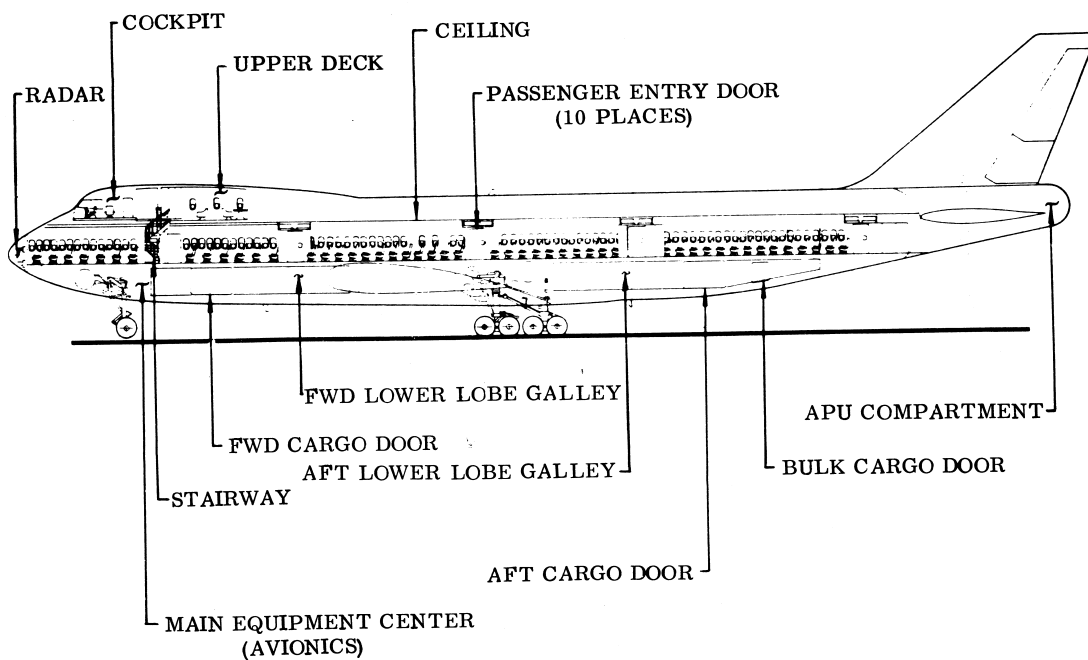


CONDITIONS
 Turn Initiated at 10 kts
 Max 70° Nose Steering
 Body Gear Steering
 No Braking
 Dry Pavement

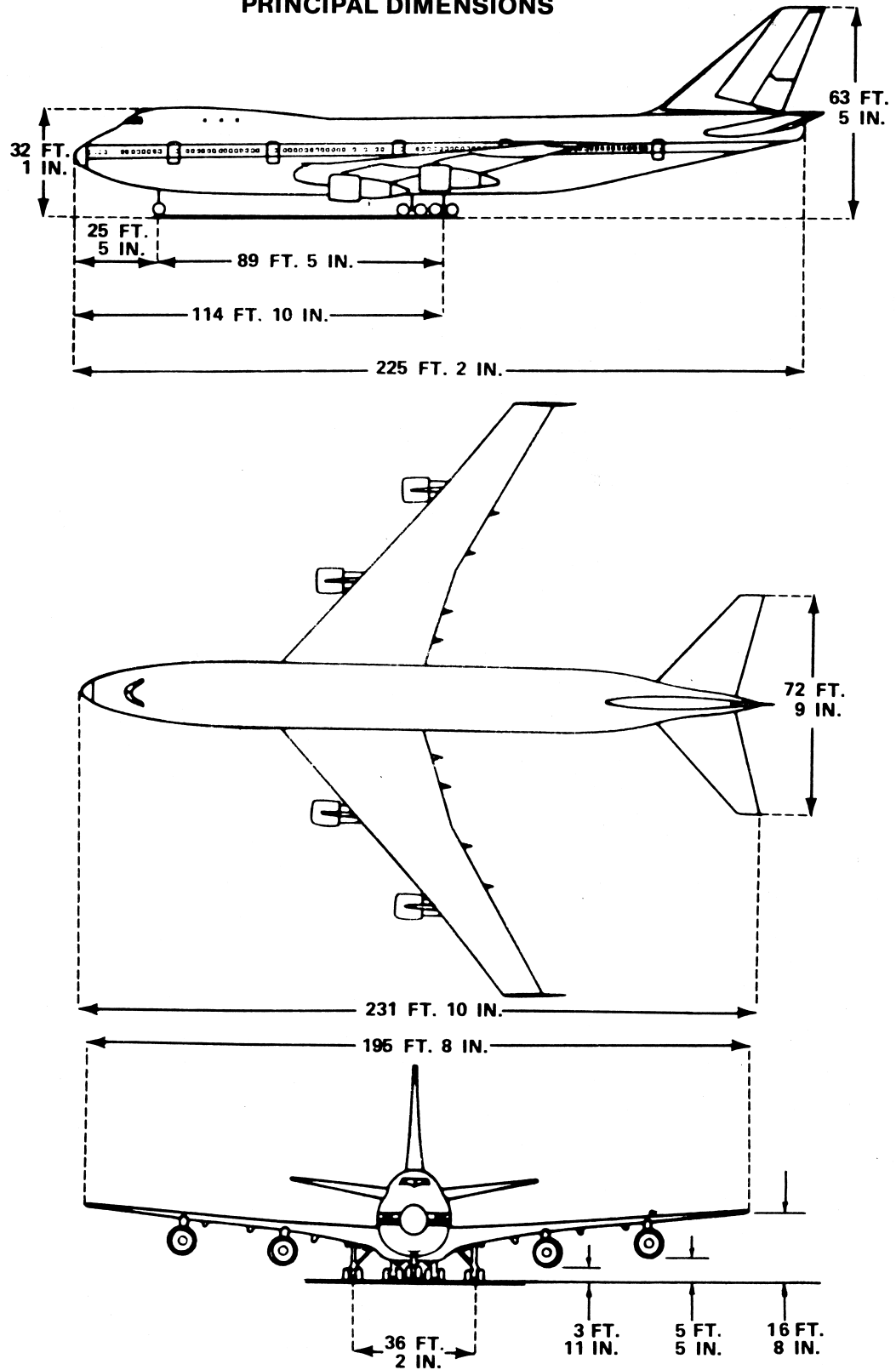
Minimum Pavement
 Width for 180° Turn

NOTE:
 Taxi Speed, G.W., C.G., Runway
 Conditions and Nose Wheel Steering
 will affect turn radius and location
 of turn center.

COMPARTMENTS

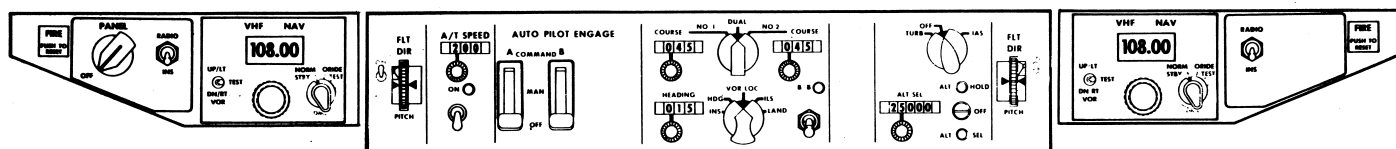


PRINCIPAL DIMENSIONS

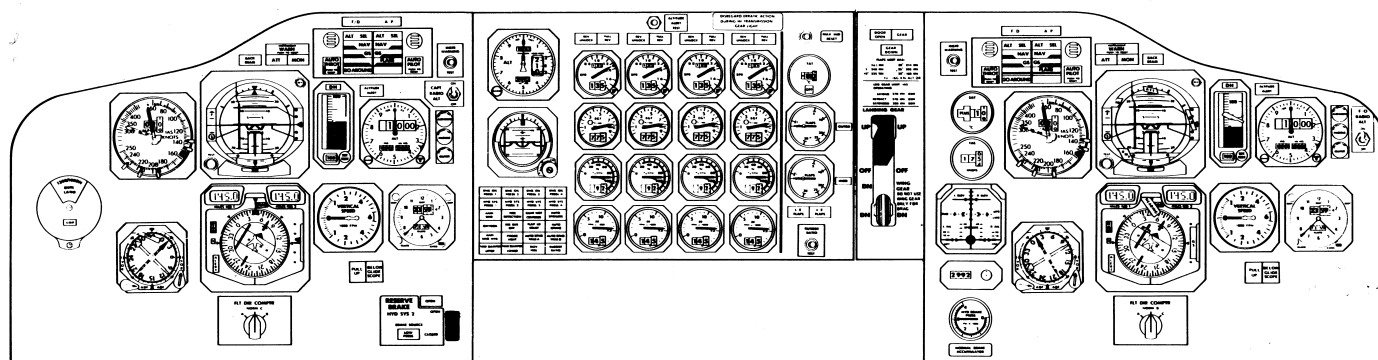


NOTE: Ground clearance dimensions shown are approximate and are based on full fuel and 713,000 lbs. Gross Weight.

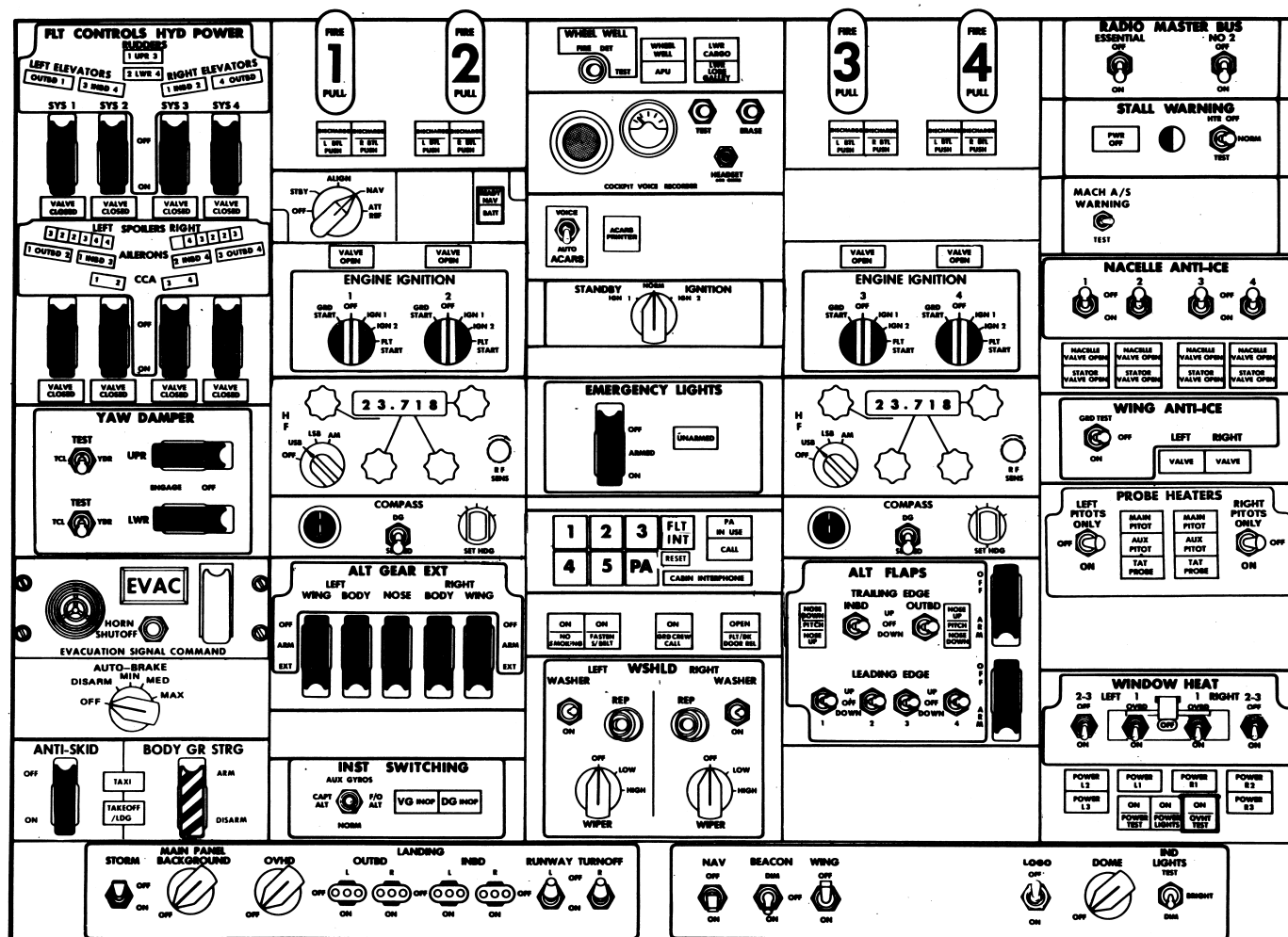
PILOTS' LIGHT SHIELD



CENTER INSTRUMENT PANEL



PILOTS' OVERHEAD PANEL

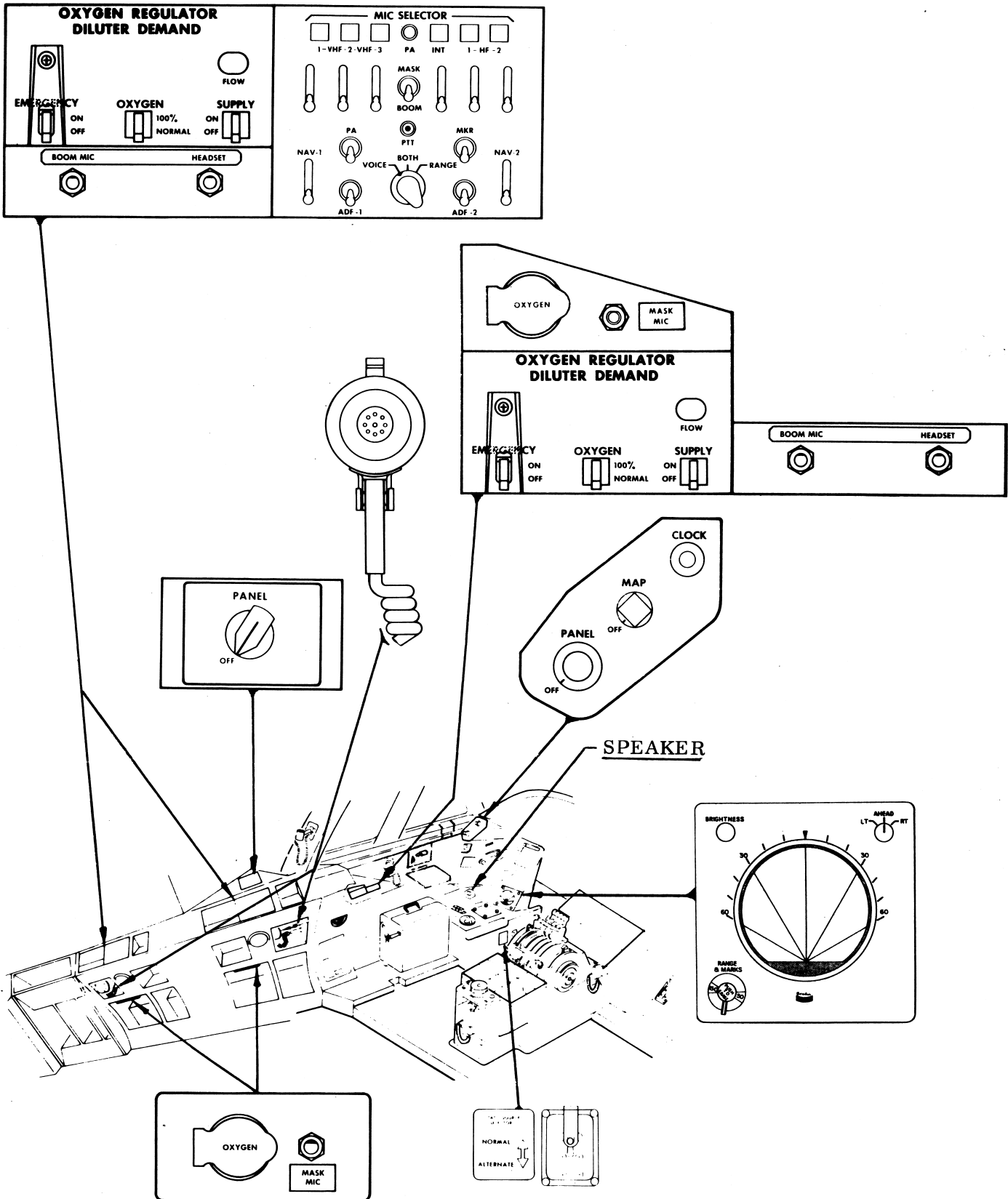


The diagram illustrates the cockpit electronics panels for a Cessna 441 Conquest II. It is divided into three main sections:

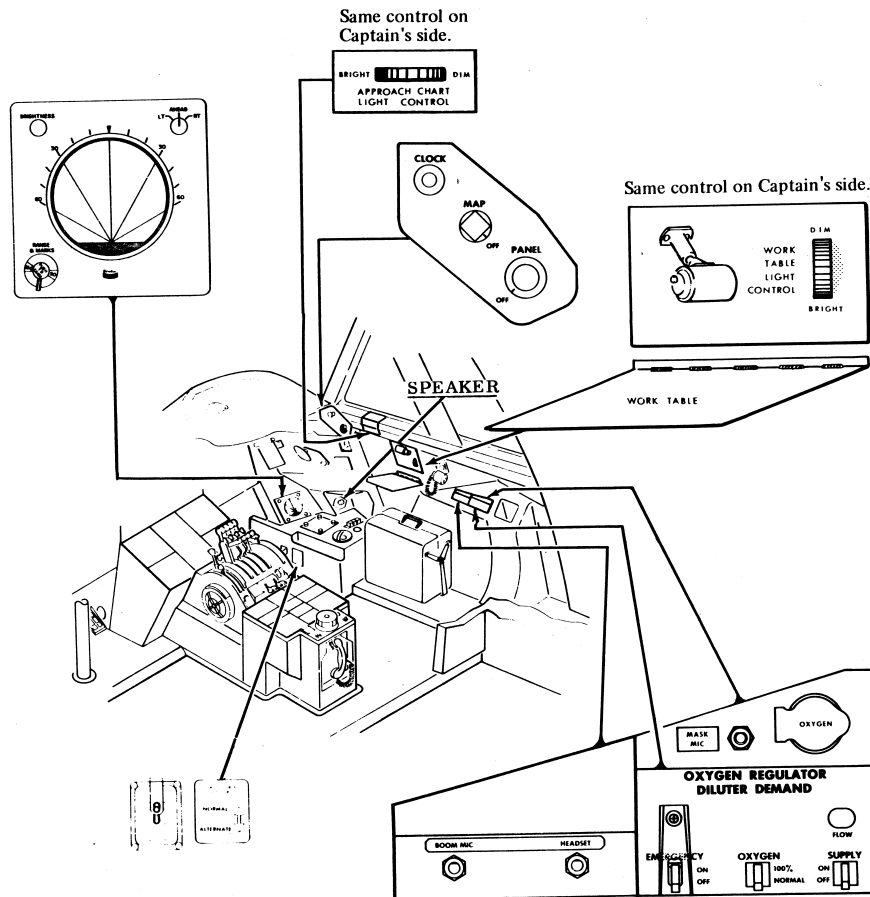
- FORWARD ELECTRONICS PANEL:** This section at the top contains two identical sets of controls. Each set includes a digital display (000000-999999), a VHF COMM section with a frequency selector (118.00), a NAV section with a frequency selector (45.50), and an engine monitoring section with a tachometer (0-3000 RPM) and a fuel gauge (0-100). The panel also features various switches for NAV, VHF, and engine monitoring.
- AFT ELECTRONICS PANEL:** This section in the middle features a central radar display with a scale from 0 to 100. It includes a VHF COMM section with a frequency selector (118.00), a frequency selector (45.50), and a power switch. The panel also features various switches for NAV, VHF, and engine monitoring.
- ALTITUDE AND WARNING HORN SECTION:** This section at the bottom includes a large circular altimeter with a scale from 0 to 10,000 feet, a warning horn control, and a fuel gauge. The panel also features various switches for NAV, VHF, and engine monitoring.

The diagram also shows the physical layout of the panels in the cockpit, with labels for "FORWARD ELECTRONICS PANEL" and "AFT ELECTRONICS PANEL".

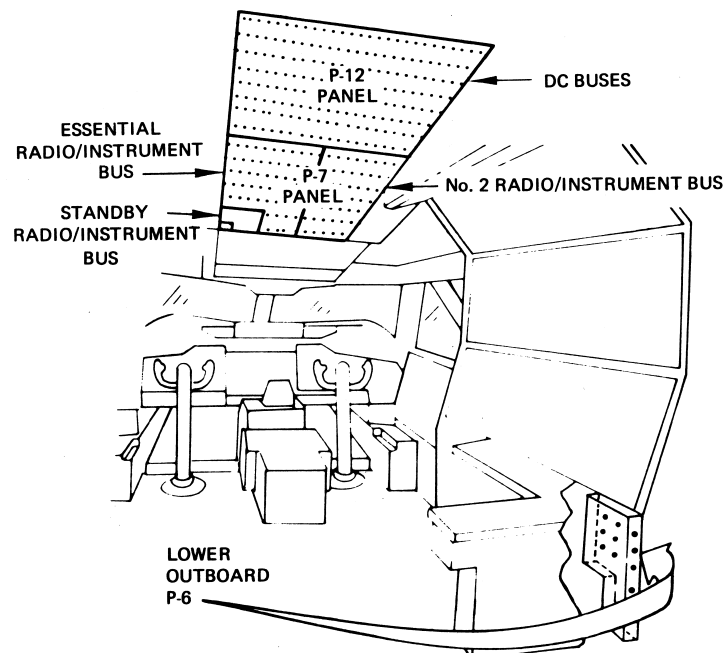
CAPTAIN'S AUXILIARY AND OBSERVERS' PANELS



FIRST OFFICER'S AUXILIARY PANEL

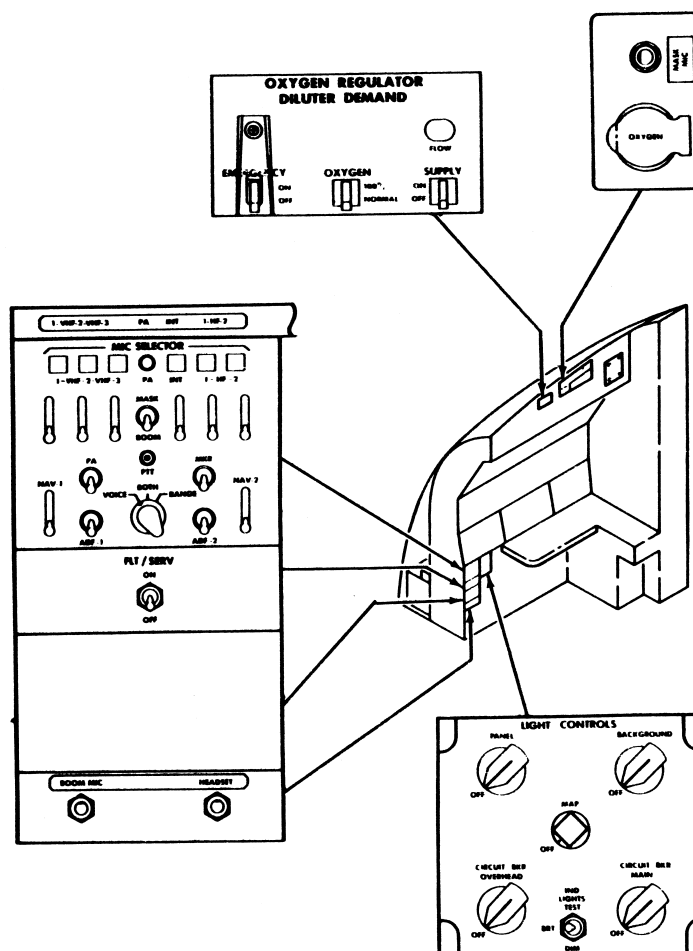


OVERHEAD CIRCUIT BREAKER PANELS (P-7 & P-12) AND LOWER OUTBOARD CIRCUIT BREAKER PANEL (P-6)

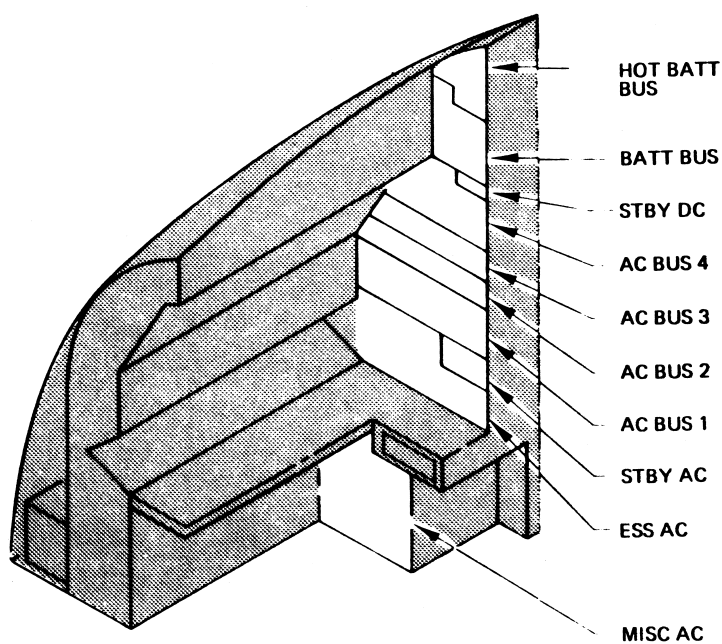


FLIGHT ENGINEER'S UPPER AND LOWER PANEL

FLIGHT ENGINEER'S AUXILIARY PANEL



FLIGHT ENGINEER'S UPPER AND LOWER PANELS MAIN CIRCUIT BREAKER PANEL (P-6)



DEFINITIONS

ACM — Air Cycle Machine — An integral part of the air conditioning package that conditions engine bleed air.

ADI — Attitude Director Indicator — Provides attitude, localizer, glide slope and flight director information.

ADP — Air Driven Hydraulic Pump.

AHSU — Attitude Heading Sensing Unit — A vertical and directional gyro unit on freighters that can be selected to provide stabilization to the Capt's or F/O's instruments.

APU — Auxiliary Power Unit — A small turbine engine used to provide electrical power and pneumatic air for ground operation.

BTB — Bus Tie Breaker — Used to connect a numbered load bus to the sync bus.

CADC — Central Air Data Computer — A computer that uses raw data from the pitot-static sources and temperature sensors to compute altitude, airspeed, mach and static air temperature.

CCA — Central Control Actuator — Uses hydraulic power to augment inputs from the control wheels and autopilots to the aileron programmers and spoiler mixers.

CSD — Constant Speed Drive — A hydro-mechanical unit mounted on each engine to maintain a constant generator speed and generator frequency output regardless of engine speed.

EDP — Engine Driven Hydraulic Pump.

EPR — Engine Pressure Ratio — The EPR gauge is the primary thrust setting instrument on the 747.

Field Breaker — Used to connect a generator field circuit to its generator.

GB — Generator Breaker — Used to connect an operating generator to its load bus.

HSI — Horizontal Situation Indicator — Displays compass and raw data radio or INS information.

INERTIA REELS — Hand held devices stowed in the cockpit that permit flight crew/courier evacuation through the overhead escape hatch.

KVAR — Kilovolt Ampere Reactive — Indication of reactive load on the engine driven generator.

KW — Kilowatt — Measure of the engine driven generators real load.

MHRS — Magnetic Heading Reference System — A gyro stabilized compass system.

NACTAI — Nacelle Thermal Anti-Ice — Provides anti-ice capability to engine inlet cowls.

P-6 — Circuit Breaker Panel — Consists of three subpanels: Upper P-6, Lower P-6 and Outboard P-6. Contains both AC and DC circuit breakers.

P-7 — Circuit breaker panel to the rear of the pilot's overhead. Contains breakers for instrument and radio power.

P-12 — Circuit breaker panel aft of P-7. Used for DC power distribution.

PACK — Air Conditioning Package — Combination heat exchanger and air cycle machine used to condition air for crew and passenger comfort.

PMG — Permanent Magnet Generator — Used to provide field excitation and control of main AC generators.

PSU — Passenger Service Unit — Provides outlet for gasper air, emergency oxygen, reading light and attendant call light.

RMI — Radio Magnetic Indicator — Provides compass heading information together with VHF/ADF bearing information.

PROBE HEAT — Anti-ice capability for the pitot and temperature probes.

SAT — Static Air Temperature — Temperature corrected for ram rise.

SQUIB — An electrically detonated explosive charge used to rupture extinguisher bottle diaphragm for release of freon into the discharge manifold.

SSB – Split System Breaker – Used to split the Sync Bus between No. 2 and No. 3 generators so that numbers 1 and 2 are paralleled and numbers 3 and 4 are paralleled. Permits unlike sources to power opposite sides of the Sync Bus. Used in normal paralleling of engine driven generators No. 1 and 2 with No. 3 and 4.

SYNC BUS – Ties the four main A/C load busses and generators together for equal load sharing.

TAT – Total Air Temperature – Uncorrected temperature as measured by the temperature probes.

TIME SHARED INSTRUMENTS – Where one instrument can, through switching, provide data from more than one source.

TR UNIT – Transformer Rectifier Unit – Used to convert AC power to DC power.

TRUCK – Landing Gear Truck – Consisting of four wheels on each main landing gear assembly.

ZONE TEMPERATURE CONTROL – Individual temperature control capability for each of the four aircraft zones:

Zone 1 – Cockpit

Zone 2 – First Class Section

Zone 3 – Coach Class Cabin aft to Door 4.

Zone 4 – Coach Class Cabin Door 4 to aft bulkhead.

SECTION II – SYSTEMS

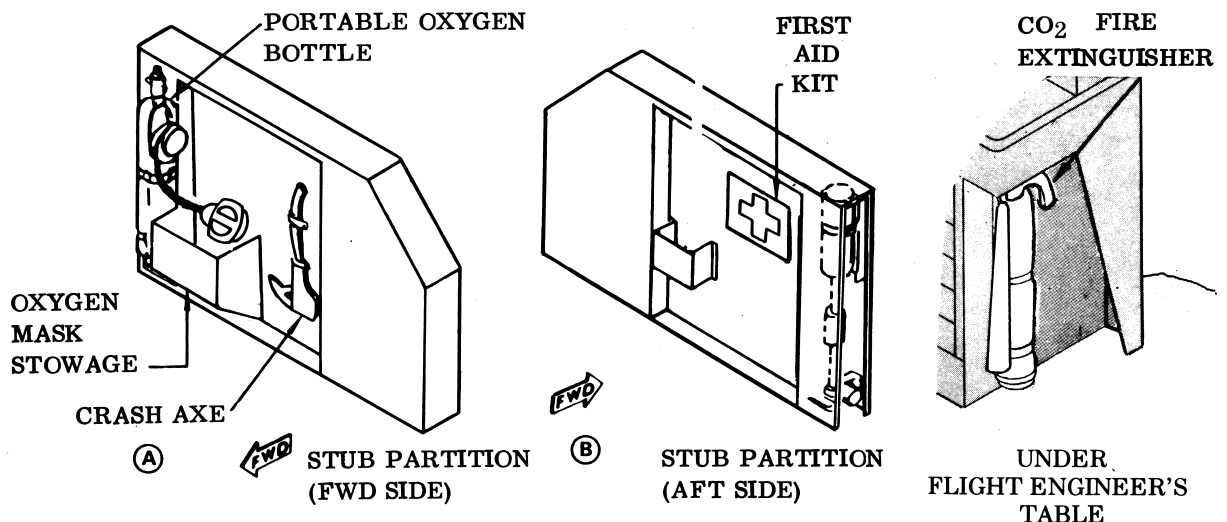
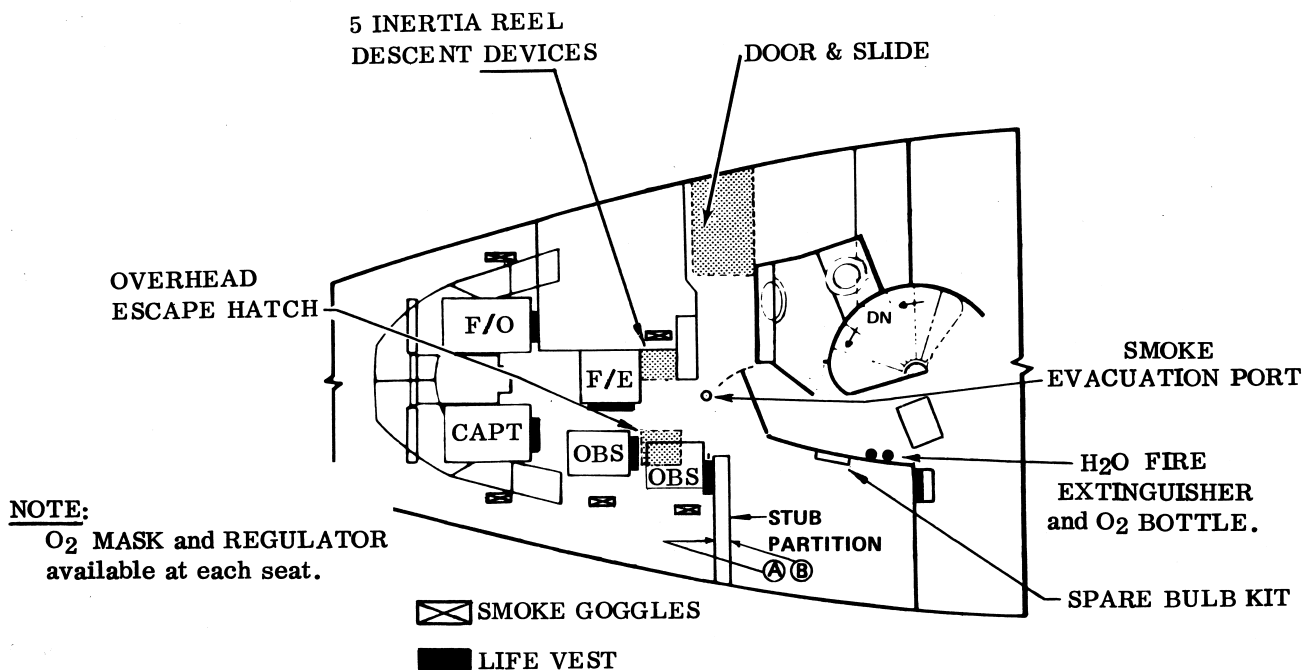
Airplane systems are presented in the same sequence as they are presented in the B-747 Operating Manual.

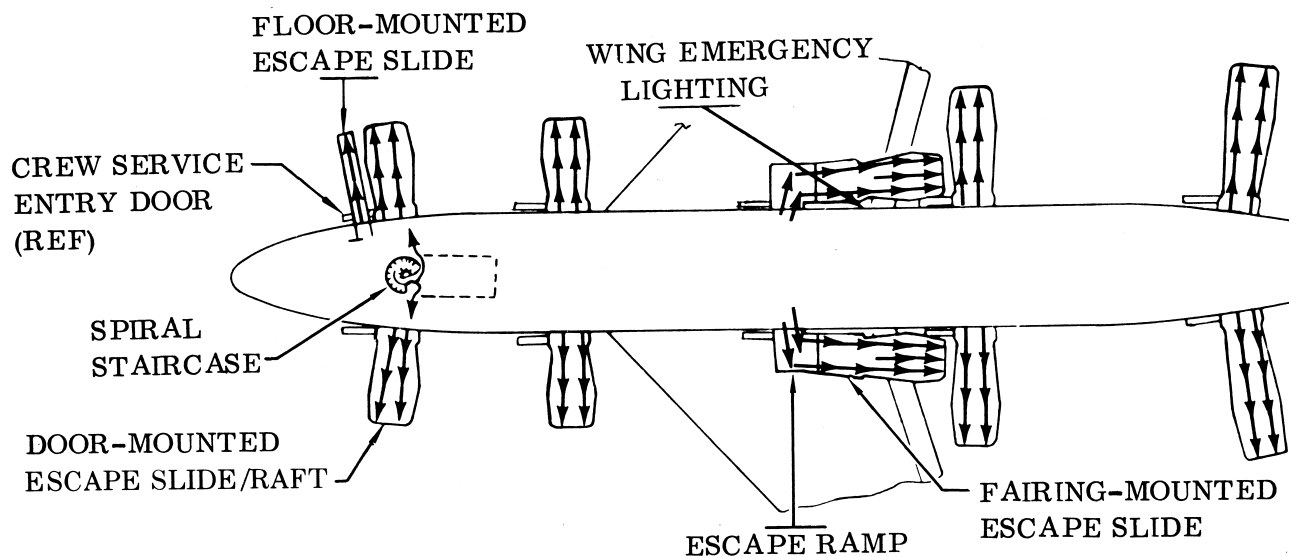
EMERGENCY EQUIPMENT

COCKPIT

Emergency equipment in the cockpit consists of a CO₂ fire extinguisher, crash axe, portable O₂ cylinder with full face mask, smoke goggles, life vests, first aid kit and inertia reel descent devices for emergency exit through the overhead escape hatch.

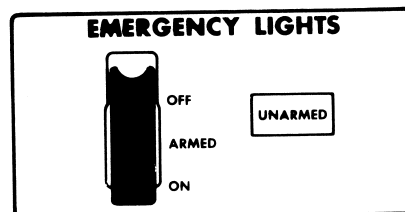
EMERGENCY EQUIPMENT – COCKPIT / UPPER DECK





Evacuation slide/rafts along with their necessary inflation equipment are mounted in the lower bustle area of each passenger cabin entry door. The two overwing exits incorporate a two stage wing ramp and off wing slide. Escape ropes for use when ditching are located at the overwing exits also. A floor mounted escape slide is provided at the cockpit crew service door and five inertial reel descent devices are mounted next to the overhead escape hatch. Cockpit windows are fixed and cannot be opened for emergency exits.

Emergency evacuation signal panels are located on the pilots' overhead and at each cabin entry door. Following activation, the horn on each of the individual panels can be silenced; however, the Evac light can be extinguished and the system rearmed only at the location where the evacuation was initiated.



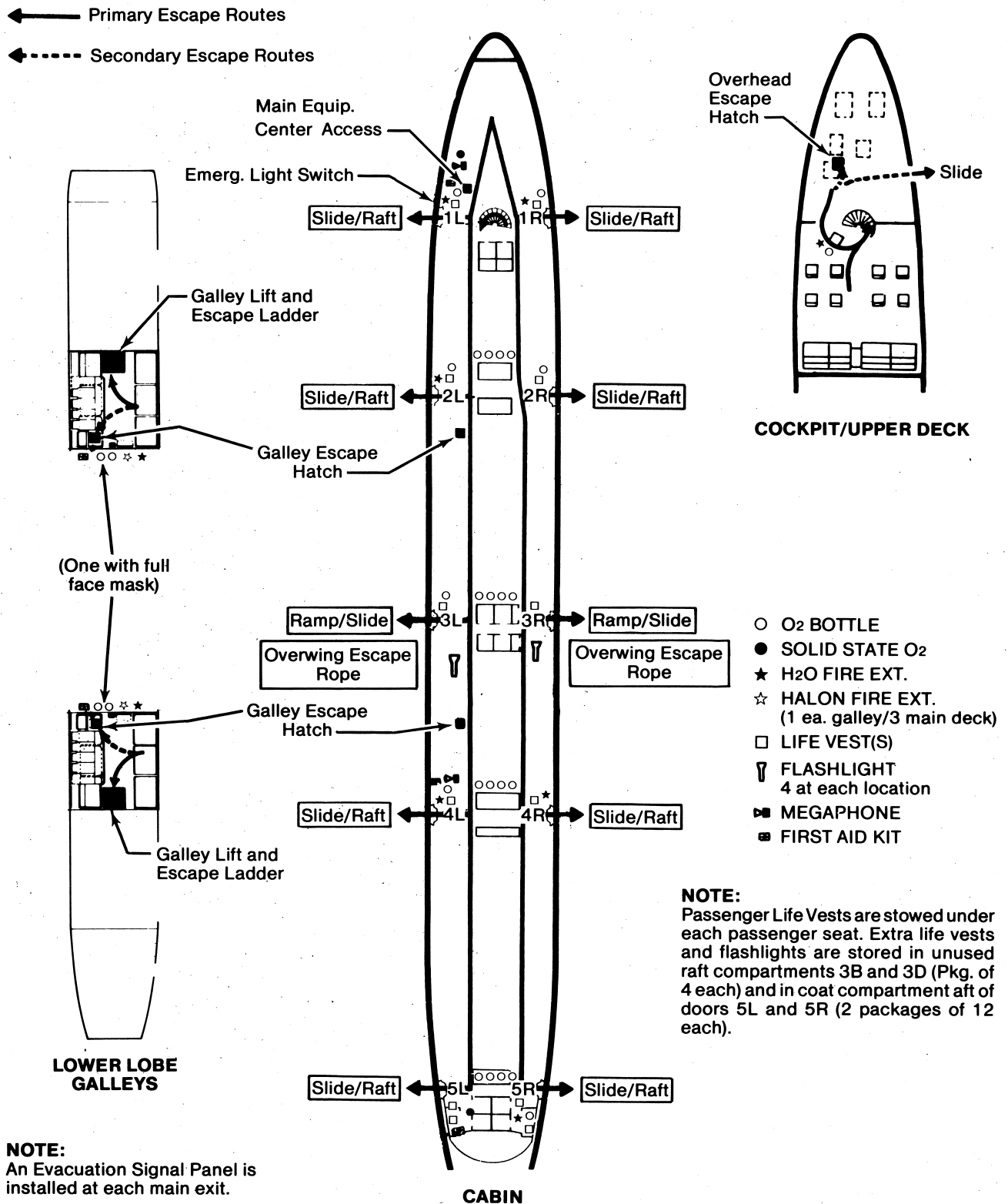
Emergency lights may be activated by use of a switch on the pilots' overhead panel or at the Flight Attendant panel at Station 1 Left. Lights are activated automatically with the pilots' Emergency Light Switch in the ARMED position and with subsequent loss of 28V DC essential power. Interior emergency lights consist of door, aisle, cross aisle and exit lights. Exterior lights illuminate the escape slides and overwing area. All emergency lights are fixed units and are not removable for use as portable light.

CABIN

Emergency equipment in the B-747 passenger cabin consists of H₂O fire extinguishers, portable O₂ cylinders, solid state O₂ units, first aid kits, megaphones, flashlights, and life vests. Additionally, in the lower lobe galleys, are portable O₂ cylinders, one with demand regulator and full face mask, H₂O and dry chemical fire extinguishers

and first aid kits.

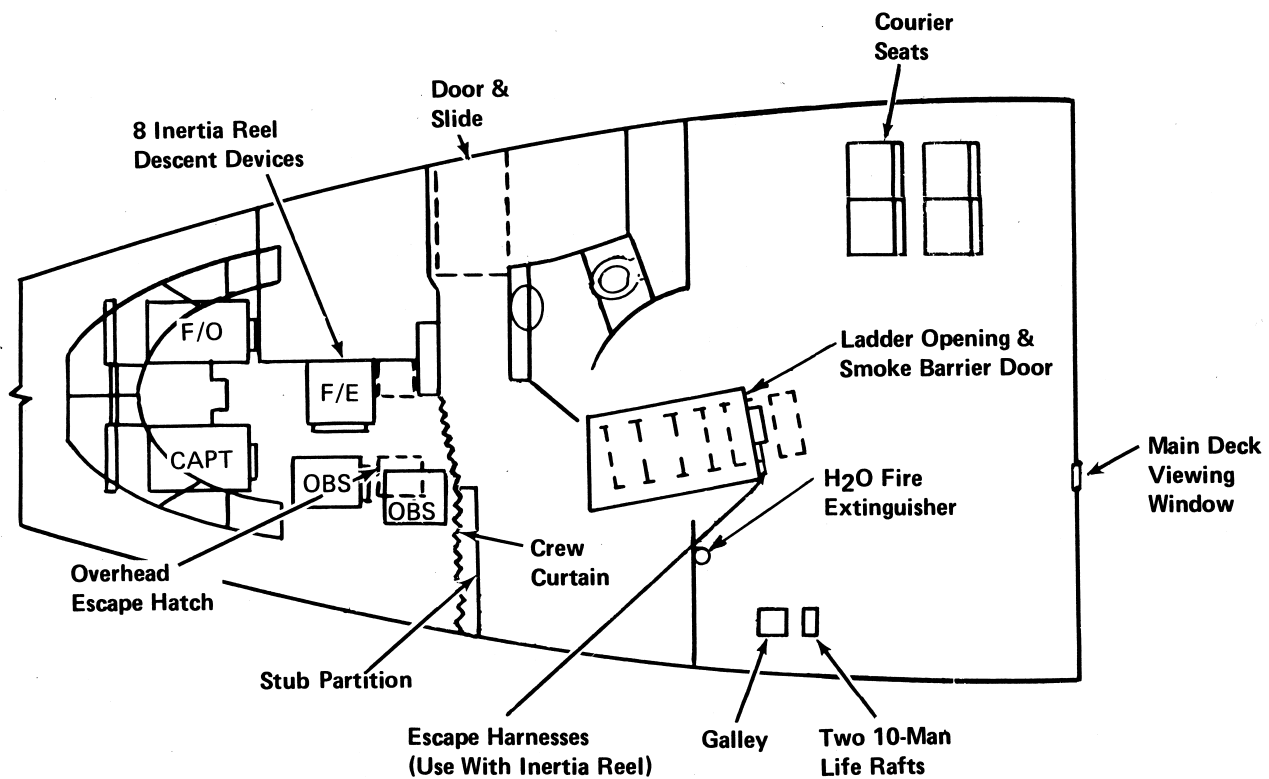
The main cabin exits are numbered from front to rear one thru five and labeled left or right. This 1L would be the first door on the left hand side.



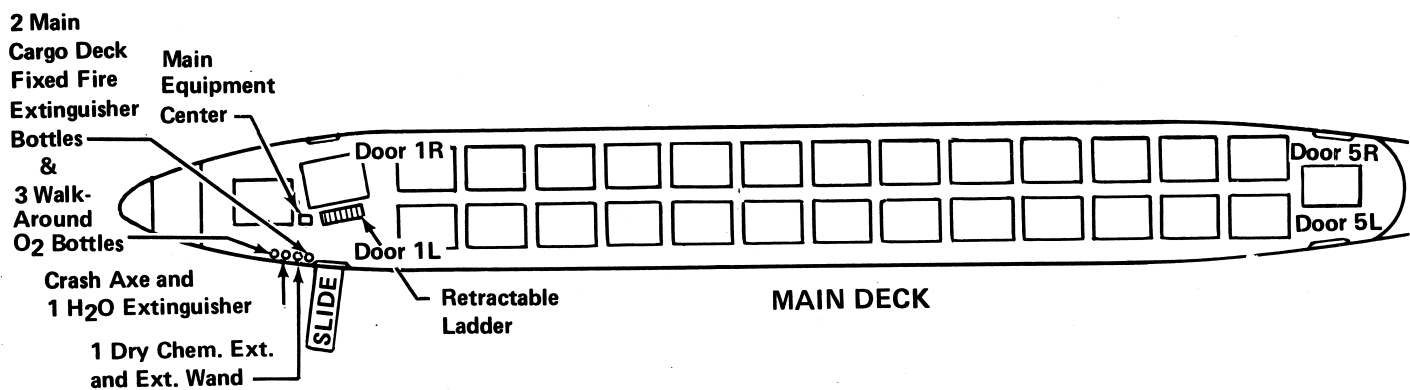
FREIGHTER CONFIGURATION

Cockpit emergency equipment in the B-747 freighter is essentially the same as for the passenger version. Three additional inertia reel descent devices with harnesses are provided for use by upper deck couriers. The evacuation signal panels have been removed.

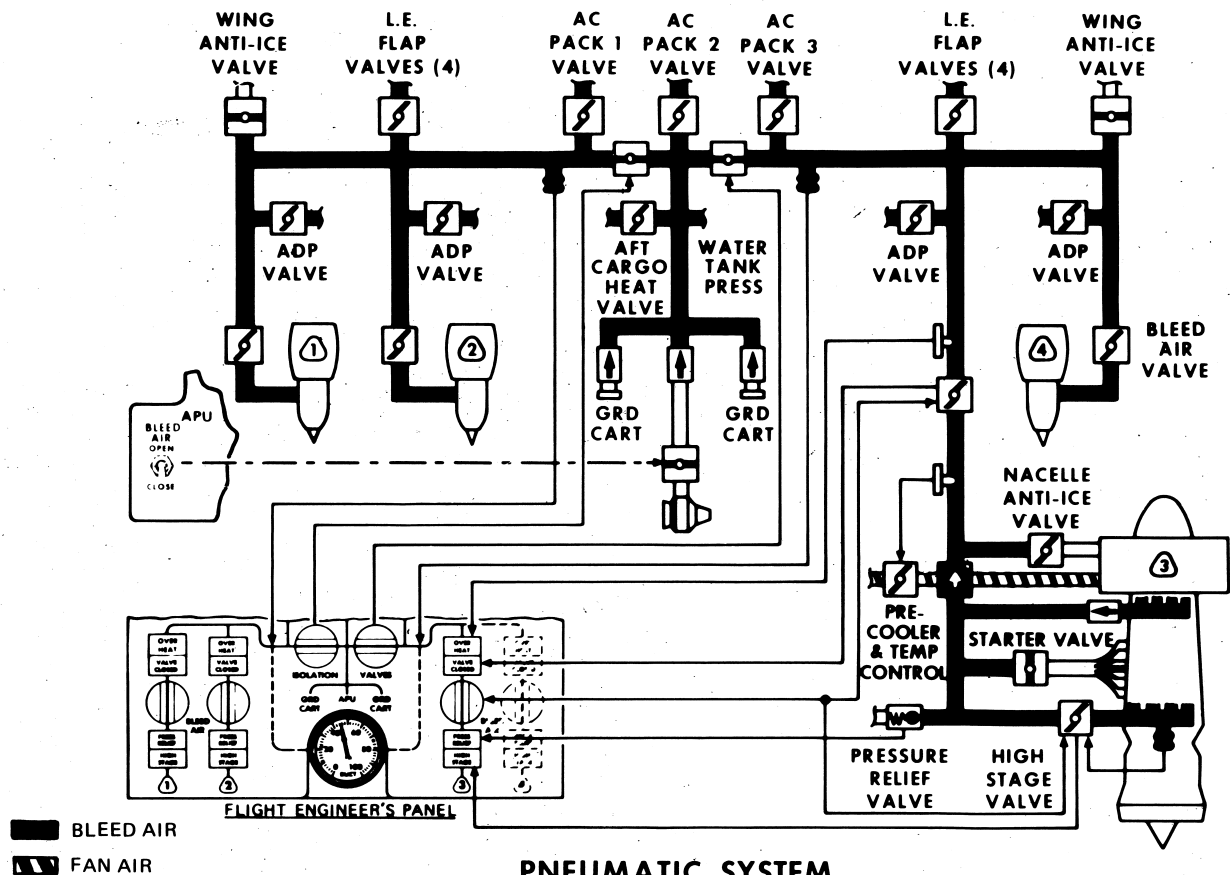
Two 10 man life rafts are secured to the upper deck floor just aft of the galley or just aft of the stub partition.



The freighter has four main deck entry doors. Door 1L has an automatic door mounted escape slide and rope. Doors 1R, 5R, and 5L have escape ropes only. Doors 2, 3 and 4 Left and Right have been sealed.



PNEUMATICS, AIR CONDITIONING AND PRESSURIZATION



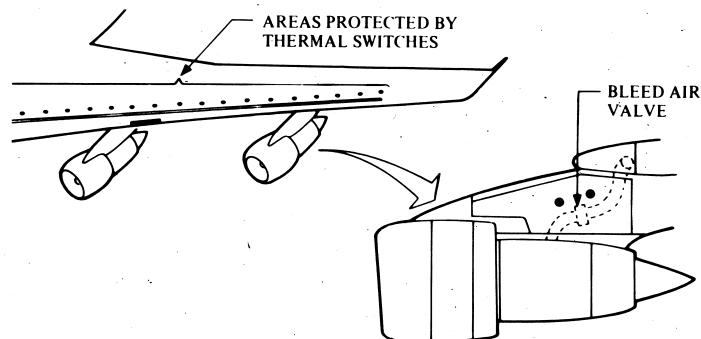
PNEUMATIC SYSTEM

The primary source of air for the pneumatic system is engine bleed air. During ground operation air may be supplied by the APU or by ground air cart.

The pneumatic system provides air for:

- Engine starting
- Air Conditioning
- Pressurization
- Anti-Ice for wing leading edge
- Pneumatic drives for leading edge flaps
- Air driven hydraulic pumps
- Aft cargo heat
- Water and hydraulic reservoir pressurization.

In order to maintain the desired duct pressure, bleed air is extracted from either the low or high stage engine compressors; the pressures and temperatures are regulated and delivered to a common pneumatic duct. For take-off, climb, cruise and other high thrust settings, low stage air is used. For descent, taxi, and other low thrust settings, high stage air is used.

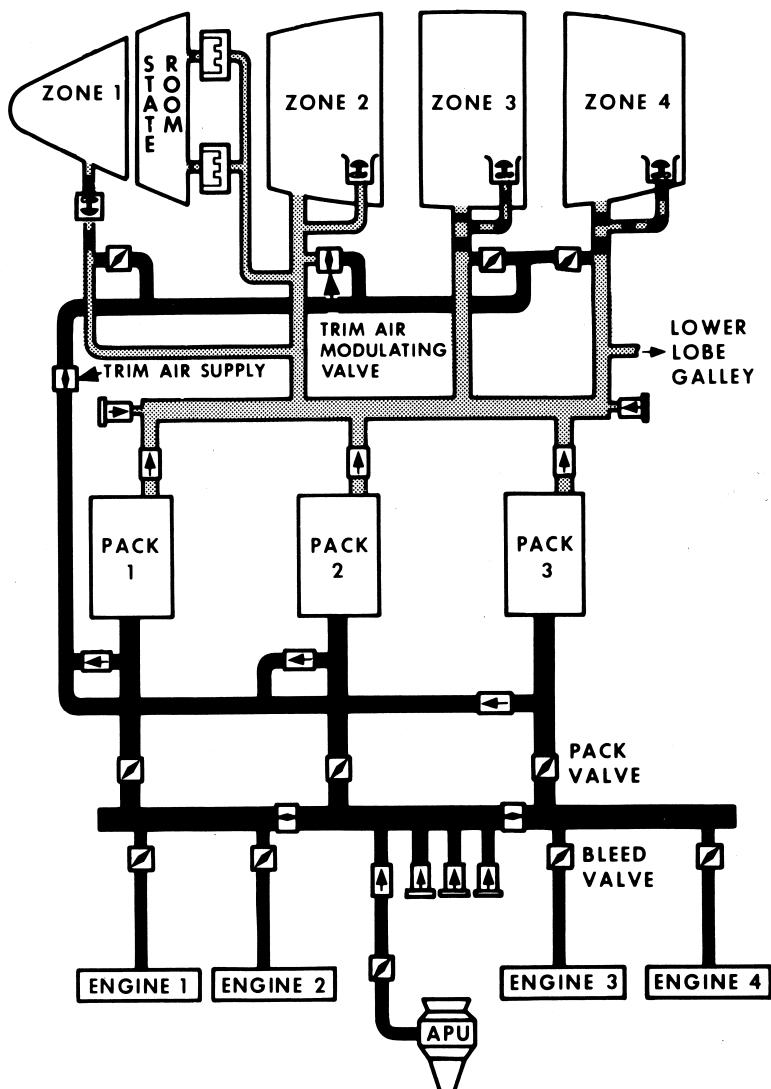
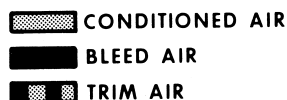
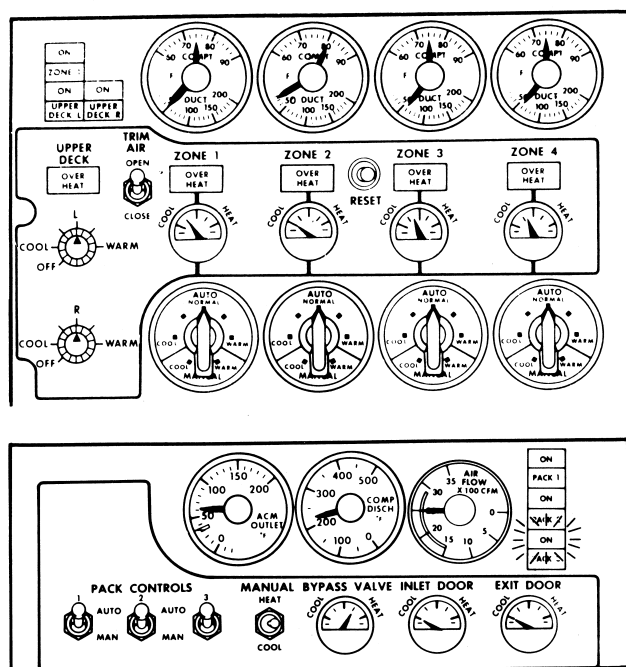


Thermal switches are located along the wing forward spar adjacent to the pneumatic duct and in each engine strut area to provide warning of duct leakage or rupture and a consequent overheat condition. Overheat warning lights are provided at the F/E panel. A test switch is used to test the continuity of the circuit.



FLIGHT ENGINEER PANEL

AIR CONDITIONING



Temperature control is divided into four air conditioned zones:

- Zone 1 – Cockpit
- Zone 2 – Forward Cabin
- Zone 3 – Mid Cabin
- Zone 4 – Aft Cabin

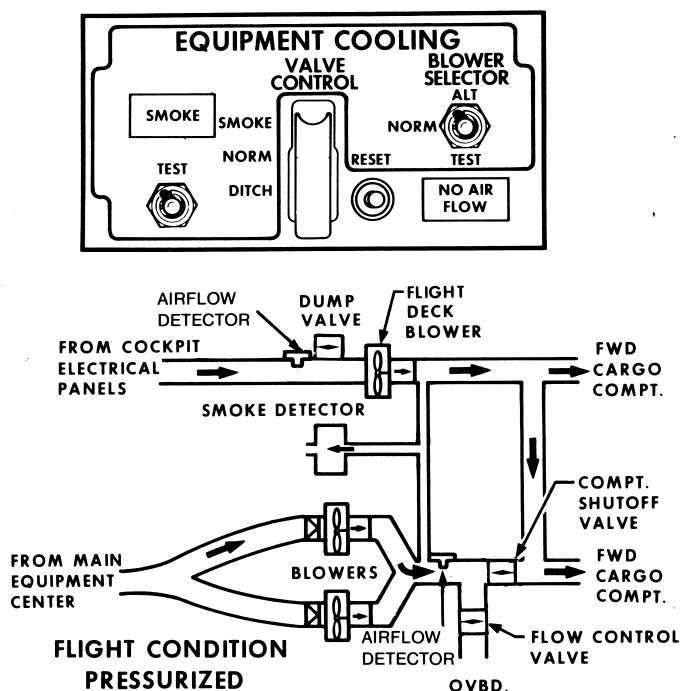
Each zone temperature is individually controlled through switches and monitoring gauges at the F/E panel. The upper deck (staterooms) are also temperature controlled.

Bleed air from the pneumatic duct is directed to three air conditioning packs where it passes through air to air heat exchangers and across expansion turbines

reducing temperatures to as low as 35°F if required. As this conditioned air passes into each aircraft zone, warm bleed air can be added to provide the individual zone temperature desired. Recirculating fans provide increased airflow throughout each zone.

The upper deck staterooms do not have hot trim air available. Electric heaters around the conditioned air ducts regulate the temperature in this area. The electric heaters are controlled at the F/E panel.

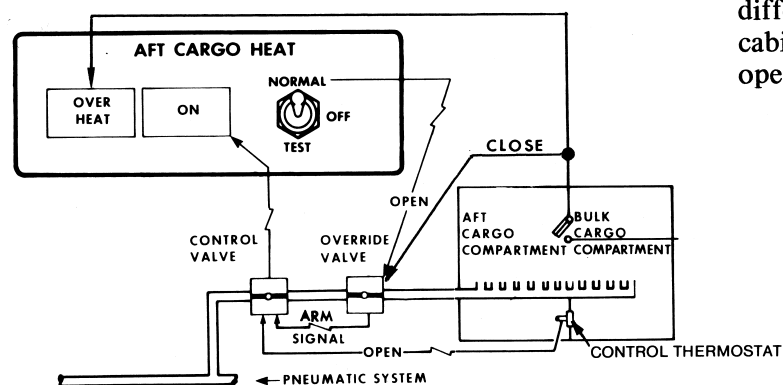
EQUIPMENT COOLING



Conditioned air is supplied to the Flight Deck and main electrical equipment centers for equipment cooling. This air is then ducted overboard or to the forward cargo compartment.

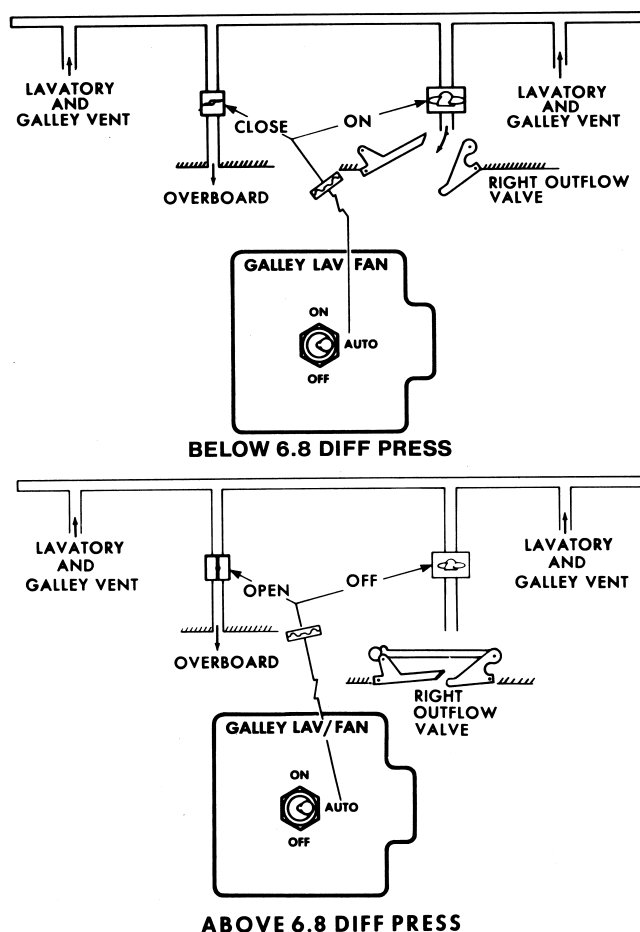
Smoke detectors and airflow sensors provide warning to the crew of malfunctions within the equipment cooling system.

AFT CARGO COMPARTMENT HEAT



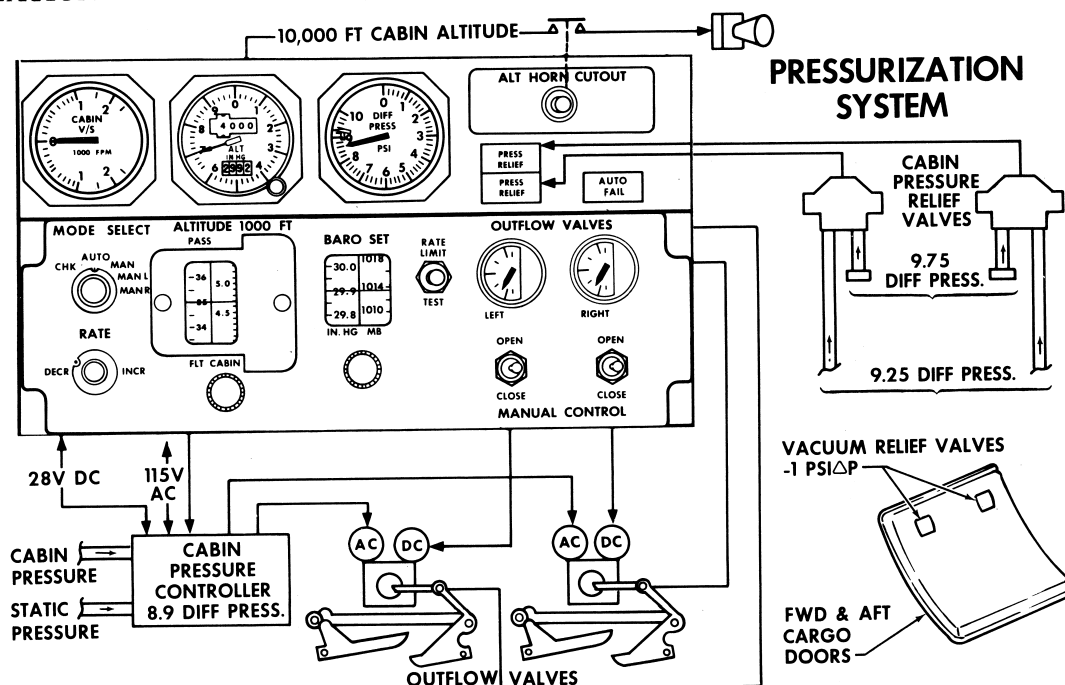
The aft cargo compartment is heated by pneumatic bleed air. A control thermostat and valve regulate this air to provide appropriate compartment temperatures. An overheat switch and override valve provides backup protection.

GALLEY/LAV VENT SYSTEM



A galley/lav vent system provides overboard venting of air from the lower lobe galley and lavatories. During normal in-flight operations, cabin pressure differential will provide venting. At less than 6.8 psi cabin pressure differential a Galley/Lav fan will operate to exhaust the air.

PRESSURIZATION



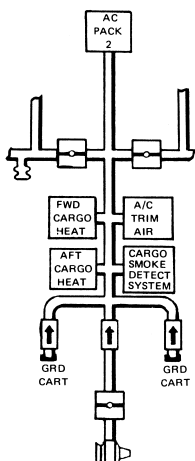
Pressurization is controlled by regulating the outflow of air from the pressurized section of the airplane. This is done by automatic or manual control of two electrically operated outflow valves.

In the automatic mode of operation, setting an appropriate altitude in the cabin altitude selector window is all that is required during climb and cruise. Prior to descent setting the appropriate field pressure altitude will permit the system to decrease cabin altitude to the proper value for landing. At touchdown the outflow valves will open to depressurize the cabin at a selected rate. In the

automatic mode of operation, maximum cabin pressure differential is 8.9 psi. Each pressure relief valve has two settings, 9.25 with a backup of 9.75, to provide structural protection. Additional protection is provided by a Rate Monitor system that takes control of both outflow valves if the cabin rate of change becomes excessive. Negative pressure protection is provided by vacuum pressure relief valves in the lower cargo doors.

The outflow valves can be operated manually from the F/E panel whenever a malfunction in the auto system occurs.

FREIGHTER CONFIGURATION



In addition to the AFT CARGO heat, the forward cargo heat, air conditioning trim air and cargo smoke detection system take bleed air from the pneumatic duct between the wing isolation valves.

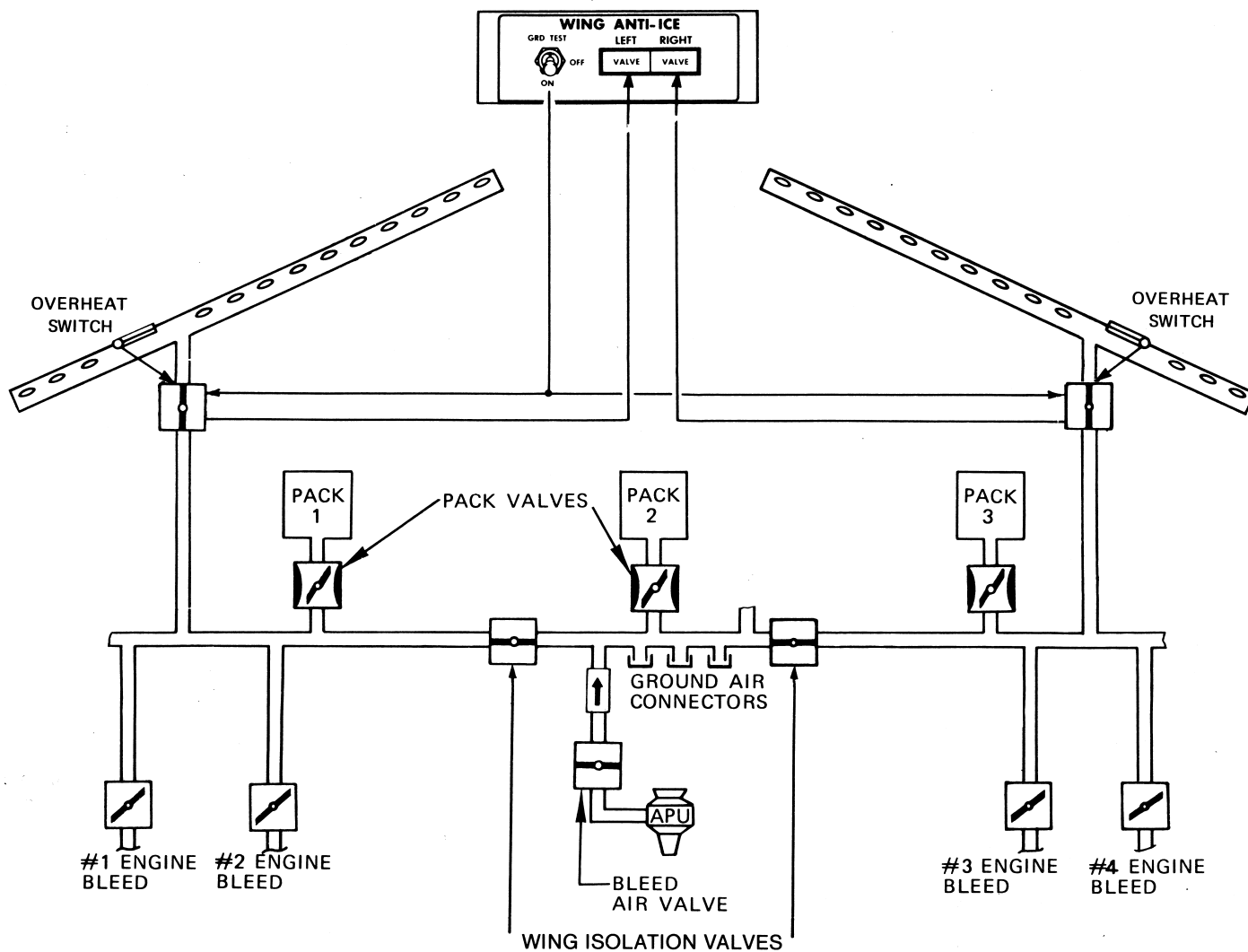
The freighters have three air conditioning zones:

- Zone 1 – Cockpit
- Zone 2 – Forward Cargo Area
- Zone 3 – Aft Cargo Area

The gasper air system and recirculating fans for Zones 2, 3 and 4 have been removed. Zone 1 recirculating fan remains but is labeled Flight Deck fan. The galley/lav vent system has also been removed. A cockpit ram air vent system with heater is installed. A lower forward cargo heat system similar to the aft cargo heat system is installed.

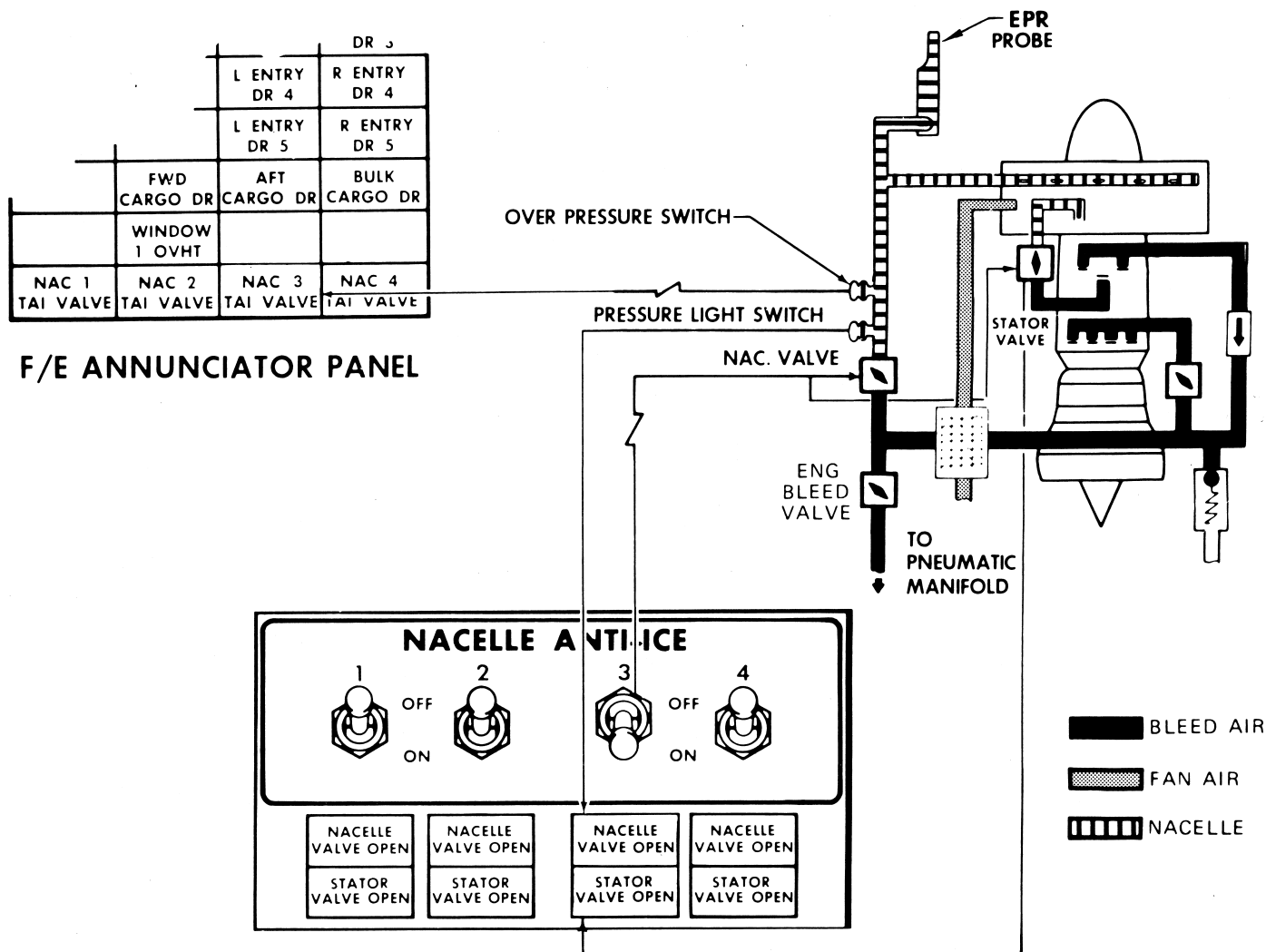
ANTI-ICE AND RAIN PROTECTION

WING ANTI-ICE



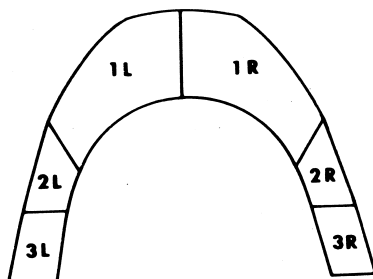
Bleed air from the pneumatic duct is directed to the wing leading edges for anti-icing from the inboard engines to the wing tip. Wing anti-ice is available in-flight only.

NACELLE ANTI-ICE

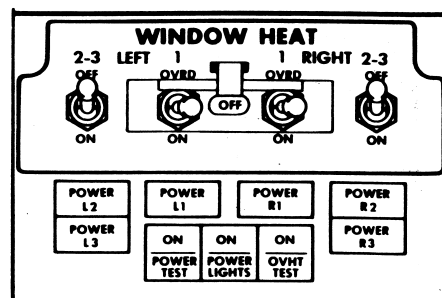


The engine inlet cowl, EPR probe and first stage stator vanes are anti-iced by engine bleed air. The engine cowl and EPR probe receives air that is pressure regulated by the Nacelle Thermal Anti-Ice valve (NACTAI). Failure of this valve to regulate the pressure may illuminate the NACTAI valve light on the F/E annunciator panel indicating an overpressure/overtemperature condition. The stator valve is non-modulating. Both the nacelle valve and stator valve on each engine are controlled by a single switch.

WINDOW HEAT

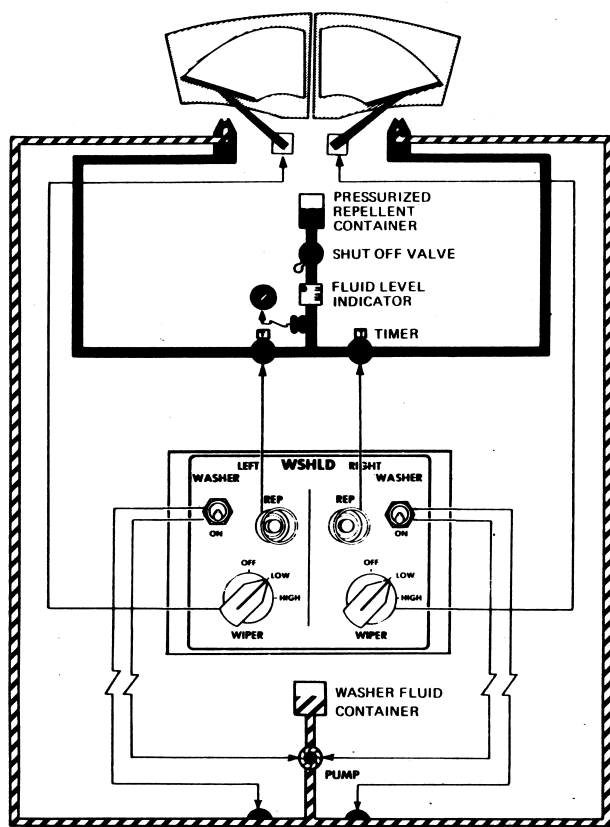


PLAN VIEW OF COCKPIT WINDOWS

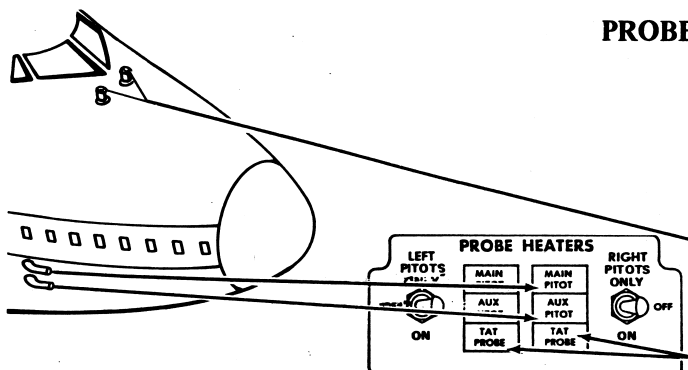


Cockpit windows 1L and 1R are electrically heated to provide anti-icing and defogging. Windows 2L, 3L, 2R, 3R are defogged only. Power to each window will automatically cycle to maintain correct operating temperature provided the window heat switches are on. Overheat protection for each window will cut off power to that window should it overheat. A Window 1 Overheat warning light is provided at the F/E annunciator panel. In addition to electric heat, conditioned air may be used to defog the interior surface of 1L and 1R.

Each number one window has an electrically operated, two speed wiper with washer and rain repellent fluid available.

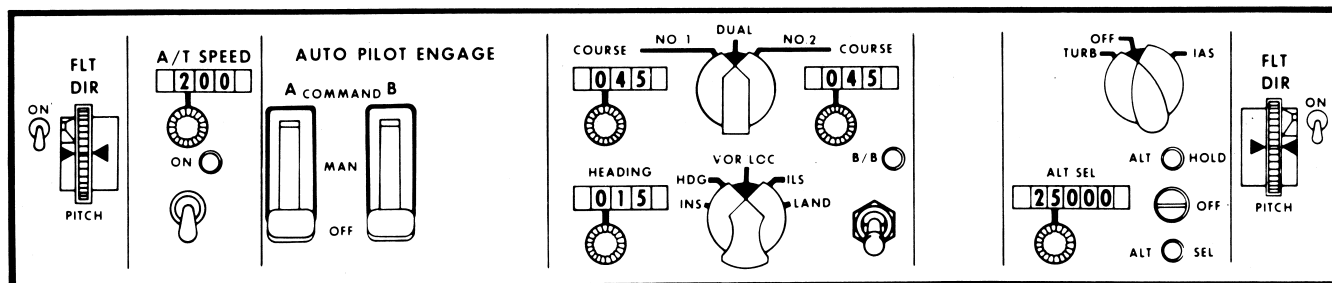


PROBE HEAT



There are two temperature probes and four pitot probes to provide signals to the central air data system and other instrumentation. There are two pitots, a main and auxiliary, on each side of the fuselage (the illustration only shows those on the right side). All of the probes are heated electrically.

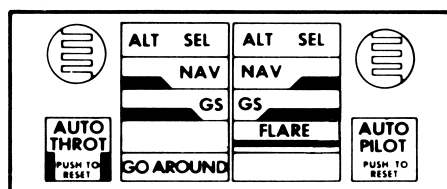
AUTO-FLIGHT



The Auto-Flight system consists of the Autopilot and Flight Director system, Yaw Damper, Automatic Stabilizer Trim and Autothrottle systems. The autopilot and flight director are very closely related and both systems are controlled through the same mode selector switches.

All Autopilot/Flight Director information is processed by the Autopilot/Flight Director Computer systems. The systems contain three independent computers, A, B and C. Computers A and B are Autopilot as well as Flight Director computers whereas Computer C is a Flight Director computer only. Autopilot channels A and B receive command signals from Autopilot/Flight Director Computers A and B respectively. Autopilot Computers A and B are selected through Autopilot switches on the lightshield. Only one computer at a time may be selected for all modes of operation except Autoland. In the Autoland mode both computers must be used. Flight Director Computers A, B and C are selectable at each pilot's station. The Captain normally monitors Computer C with Computer A as backup. The F/O normally monitors Computer B with A as backup.

The Autopilot/Flight Director Approach Progress Display lights indicate the status of AP/FD operation; AMBER lights indicate ARMED, GREEN lights indicate CAPTURE.



The dual channel autopilot provides automatic flight control in the pitch and roll axes. A Yaw Damper system provides rudder control. Features of the autopilot include:

MANUAL: Allows the pilot to turn, climb, or descend and automatically hold compass heading and altitude or attitude when selected.

COMMAND: Maintains or turns to a preselected heading, climbs or descends to and holds a preselected altitude, maintains an airspeed. Coupled operation is available for VHF or ONS/INS navigation and ILS approaches with flare for autolandings.

The Flight Director System provides a display of pitch and roll commands on the ADI to maintain or turn to a preselected heading, and maintain a selected altitude, and climb or descend to a preselected altitude (when in the capture zone). Coupled operation is available for VHF or ONS/INS navigation and ILS approaches with flare for autoland and command signals for a go-around.

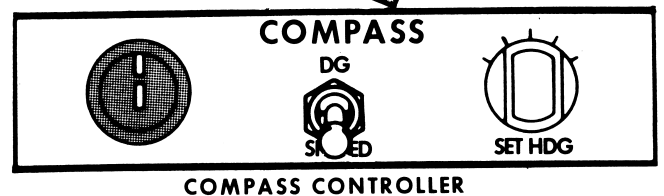
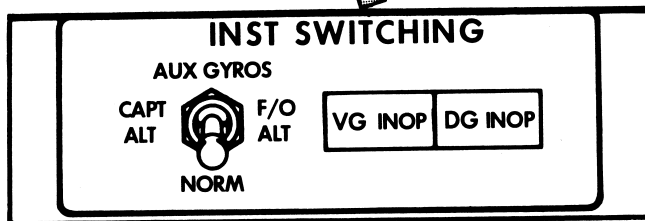
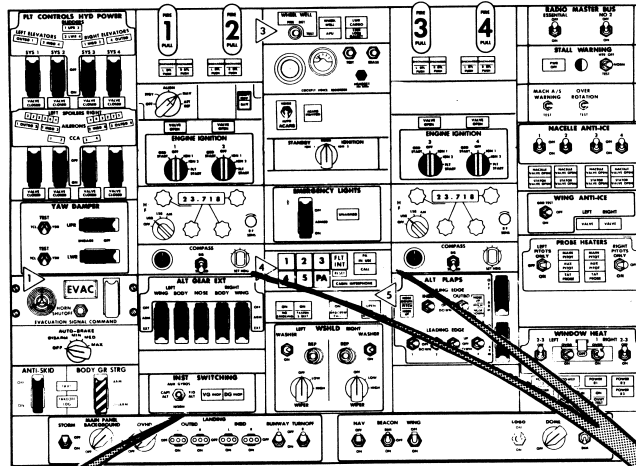
The Yaw Damper positions the rudders to damp out any yaw tendency and improve directional stability. A turn coordination feature of the Yaw Damper deflects the rudder an amount proportional to the roll rate to provide appropriate roll response for coordinated turns when the flaps are extended.

The autothrottle system provides automatic throttle control to maintain a preselected airspeed.

In the Land Mode an automatic ILS approach and landing can be made to touchdown using the Auto-Flight System. The Autopilot will control the aircraft on the localizer/glide slope. At approximately 50 feet on the Radio Altimeter the aircraft will flare and at approximately 30 feet the Autothrottle will gradually reduce throttles to idle by touchdown.

Dual Automatic Stabilizer Trim is available through the Autopilot. The stabilizer is automatically trimmed to zero the elevator load.

PILOTS' OVERHEAD PANEL



ATTITUDE SYSTEM

Attitude information is supplied to the Captain's Attitude Director Indicator (ADI) and the AP/FD Computers A and C from No. 1 INS gyro stabilized platform. Attitude information is supplied to the F/O's ADI and to AP/FD Computer B from AHSU No. 2.

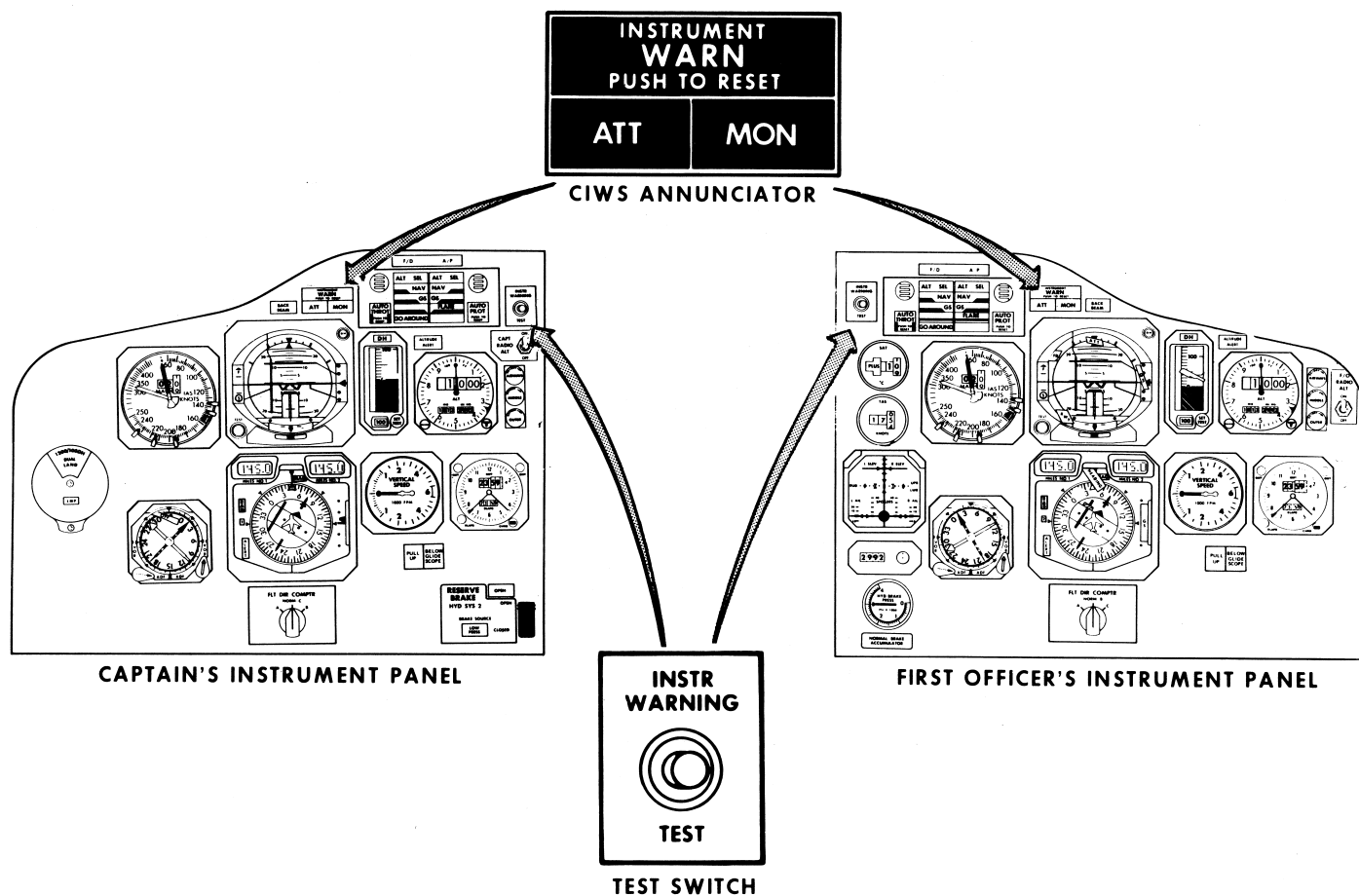
An auxiliary gyro, AHSU No. 3, is available to either crewmember if their source of attitude information fails.

COMPASS SYSTEM

A Magnetic Heading Reference System (MHRS) provides gyro stabilized magnetic heading information to the Horizontal Situation Indicator (HSI) and the Radio Magnetic Indicator (RMI). Compass information is fed directly to the Captain's and F/O's HSI and to the opposite RMI.

A compass switch permits flux valve slaving or D.G. operation of the compass systems.

CENTRAL INSTRUMENT WARNING SYSTEM

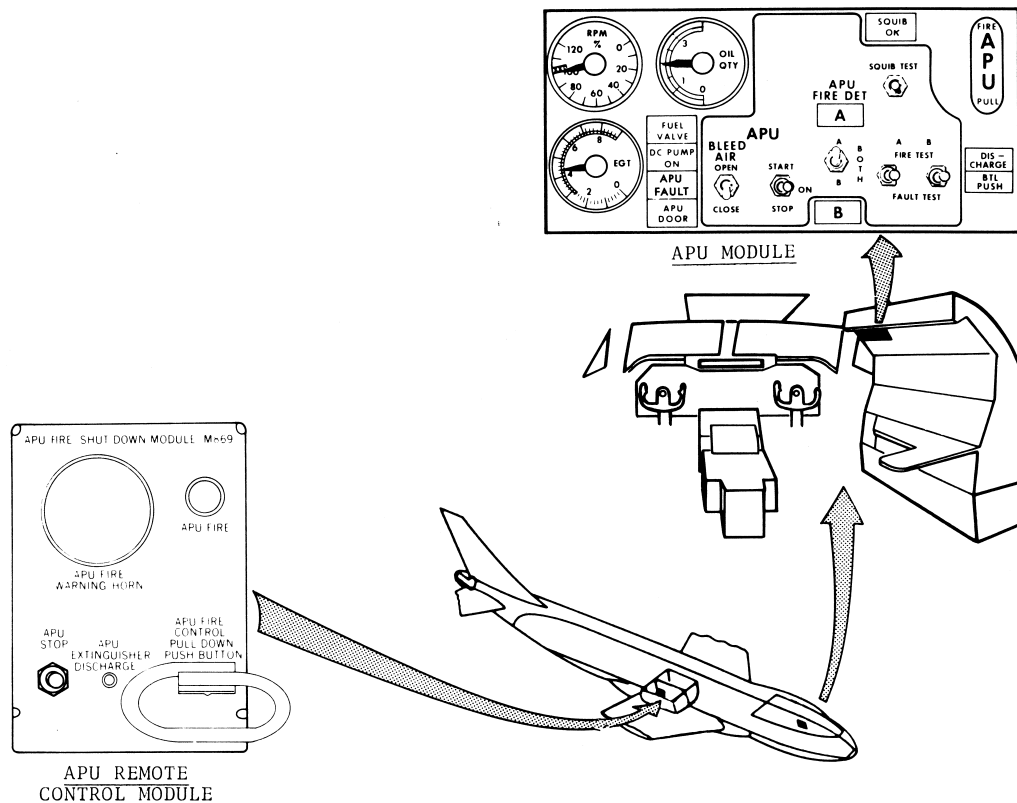


WARNING

A central instrument warning system, with **TEST SWITCHES**, monitors the pilot's instruments for flags and attitude differences.

The Instrument Warning Light comes on flashing red. The attitude (**ATT**) and Monitor (**MON**) lights come on steady amber.

APU



The APU is a gas turbine engine located in the tail cone of the airplane, and is isolated from structure and control surfaces by a fire wall. It provides electrical and pneumatic power for ground operation. The APU will not be operated during take-off, flight, or landing roll.

The APU is controlled and monitored from the Flight Engineer's panel. A remote control panel for APU fire detection and protection and emergency shutdown is located in the right body gear wheel well.

The two APU driven generators will normally supply the entire electrical load.

The APU provides bleed air for:

1. Air conditioning
2. Engine starting
3. L.E. flap drive motors
4. Air driven hydraulic pumps
5. Water tank pressure
6. Aft cargo compartment heating.

When electrical and pneumatic loads are powered simultaneously, automatic controls will reduce pneumatic power to favor electrical power when

electrical loads are high. Therefore, when large amounts of pneumatic power are required, as during engine start, electrical loads should be reduced.

Two batteries, each identical to the main airplane battery, are provided for APU starting.

Any time the APU master switch is on fuel is normally supplied to the APU from the AFT AC BOOST PUMP in fuel tank number 2, but could be supplied from any tank through the crossfeed system. If AC power for boost pump operation is not available, a DC pump, powered by the battery bus and controlled by the APU master switch, will supply fuel to the APU.

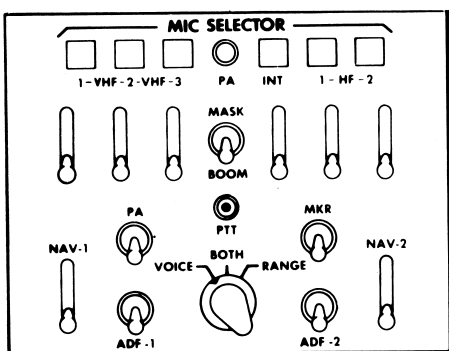
The APU has automatic shutdown circuits which will cause APU shutdown whenever certain faults are detected by closing the APU fuel supply.

There is a dual loop fire detection system with a freon bottle for fire protection. The fire bottle is electrically discharged by a switch on the APU panel. An APU fire will cause the APU fuel valve to close automatically thus shutting down the APU; however, the fire bottle will not automatically discharge.

COMMUNICATIONS

American Airlines' B-747's have two VHF communications radios, provisions for two HF radios and dual SELCAL equipment permitting call-up of individual aircraft via either VHF or HF radios. Dual ATC Transponders with altitude reporting capability are installed.

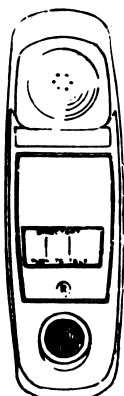
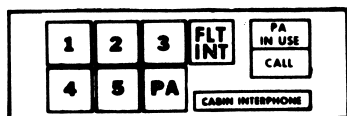
Three interphone systems are available: flight interphone, cabin interphone and service interphone. Paralleling capability exists to connect all three systems together.



AUDIO SELECTOR PANEL

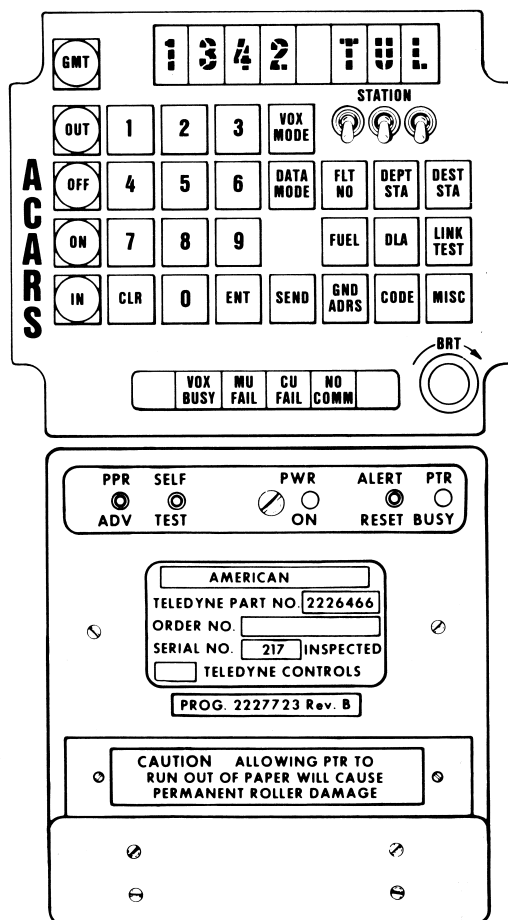
One Audio Selector Panel is located at each cockpit crew position and at each Observer's seat. There is an identical panel in the Main Equipment Center. These panels allow cockpit personnel to select radios, communicate with each other on the flight interphone, with personnel on the cabin interphone system and all stations on the service interphone system.

The pushbuttons on the top row are used to select the desired radio transmitter. The levers on the remainder of the panel are "ON" "OFF" and volume control for radio receivers. Only one transmitter may be selected at a time; however, any number of receivers may be monitored.



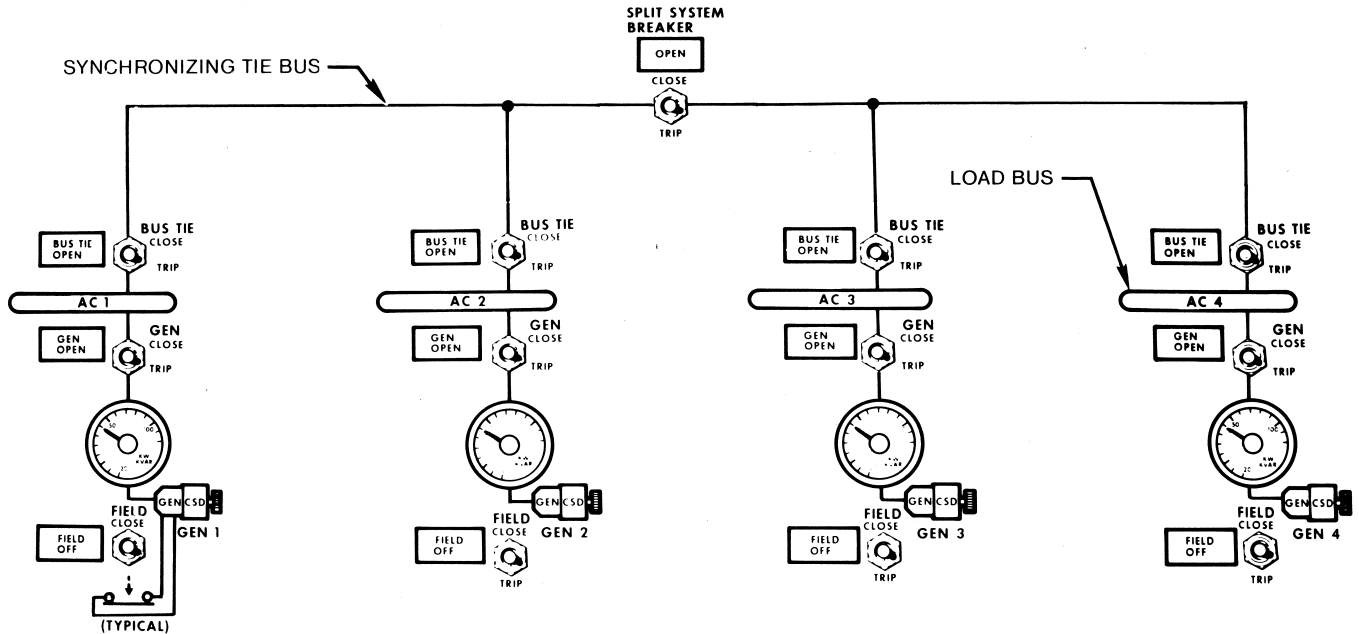
The cabin interphone system utilizes telephone handsets with a two digit dial code. The flight crew may also use the hand mike, boom mike, or oxygen mask mike for cabin communications. By pressing the FLT INT Paralleling Switch the cabin interphone is interlocked with the flight interphone.

On freighter aircraft the cabin interphone has been removed and a cargo intercom/interphone system installed.



The ARINC Communications Addressing and Processing System (ACARS) operates in conjunction with special ground based ARINC remote stations and a Central ARINC Computer for message processing and distribution. The ACARS equipment consists of a control panel and printer mounted at the F/E's station, an Auto/Voice switch on the overhead panel and a management unit located in the main equipment center.

MAIN AC ELECTRICAL POWER

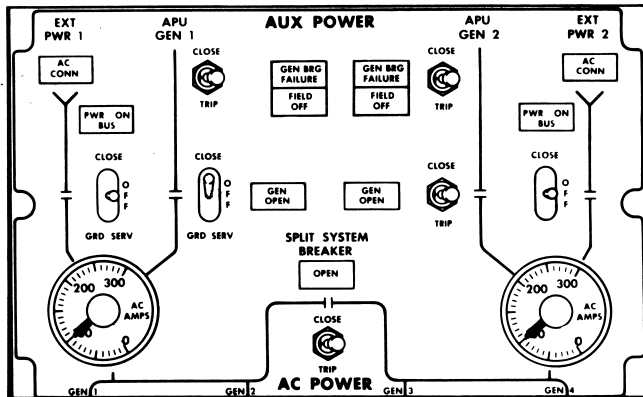


Four 115V AC, three-phase, 400 Hz engine driven generators are the primary source of aircraft electrical power. Control and monitoring of this power source is provided by the electrical power module at the F/E panel.

With engines operating and with the field switches closed, the generator breakers are closed to power the

four main AC load busses. If the bus tie breakers are closed, parallel operation (load sharing) then occurs between generators No.'s 1 and 2 and between No.'s 3 and 4. Closing the Split System Breaker (SSB) parallels all four generators through the Synchronizing Bus (SYNC BUS).

AUXILIARY ELECTRICAL POWER

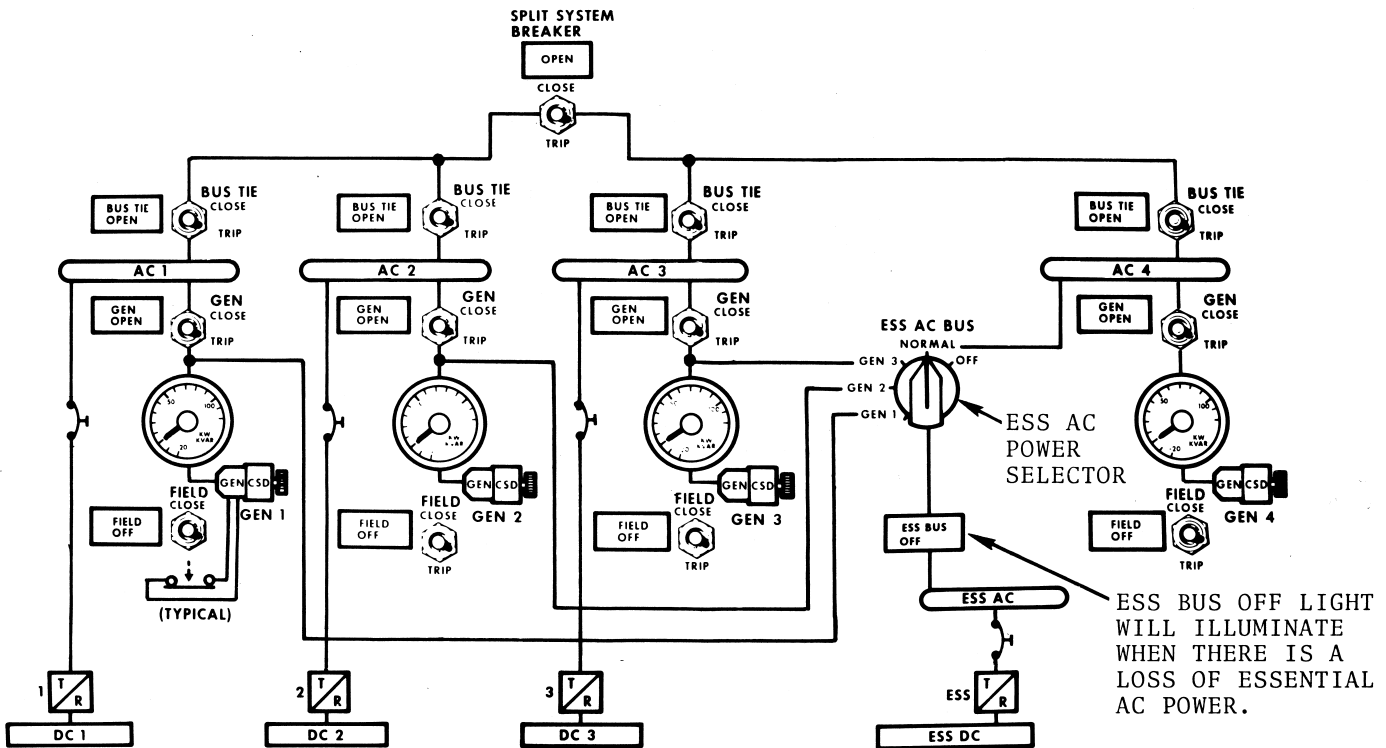


The entire aircraft electrical system can be powered by the APU generators or external power or a combination of the two. Control and monitoring of external and APU power is provided by the Aux Power Module on the F/E console.

Closing the APU generator breaker or the external power breaker will connect that power source to the "SYNC" Bus. If the bus tie breakers are closed the main load busses will be powered.

The Aux Power Module also incorporates the Split System Breaker (SSB). With the SSB "OPEN" (light illuminated) the electrical system is split, each half operating independently of the other. Since auxiliary power sources cannot be paralleled this permits a combination of power sources at the same time. The SSB can be closed to permit one external power generator or one APU generator to power the entire SYNC Bus.

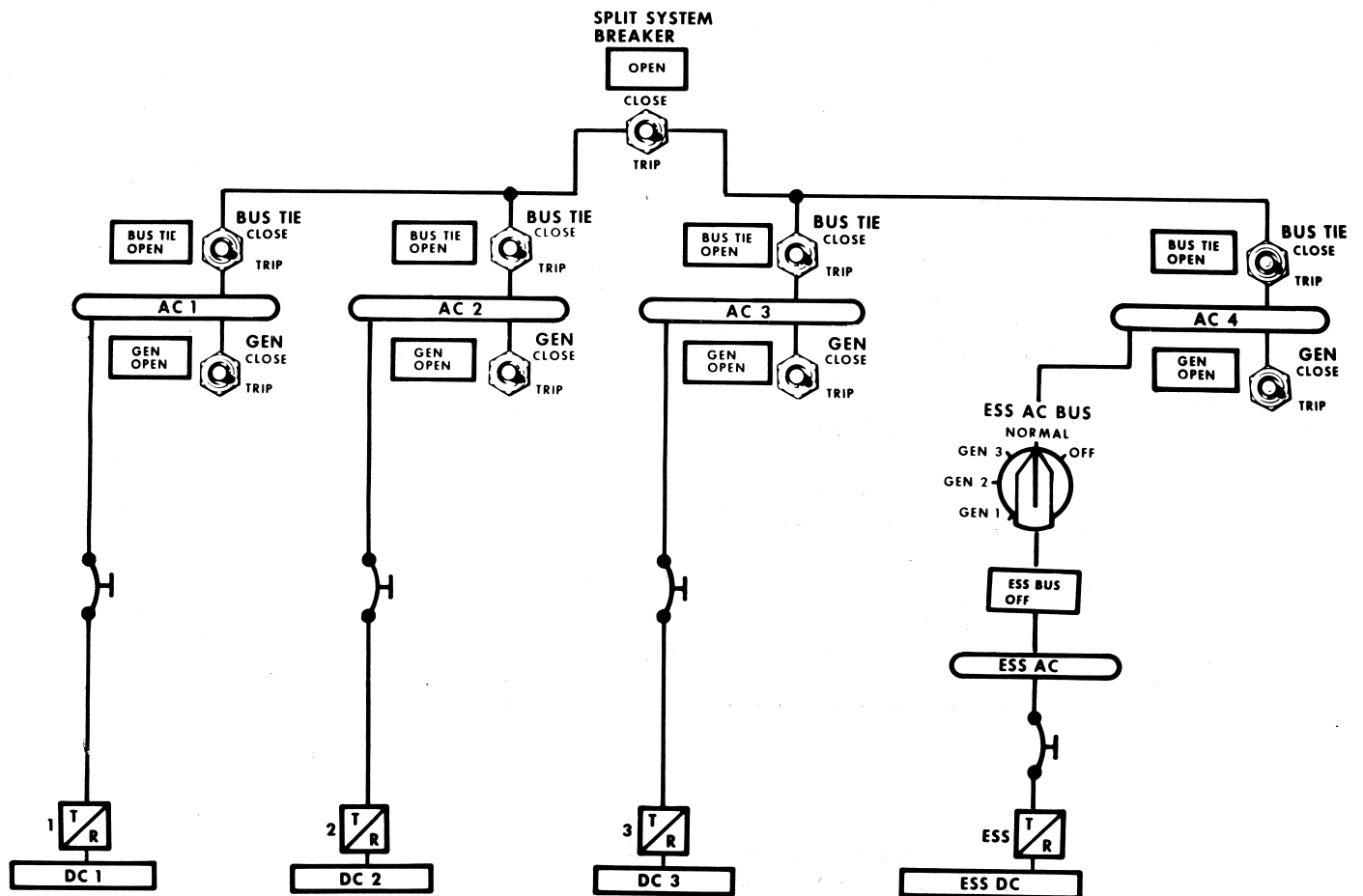
ESSENTIAL AC POWER



Essential AC power is normally provided by AC Load Bus No. 4, but can be switched to generators 1, 2 or 3 or turned off. When the Essential Power Selector

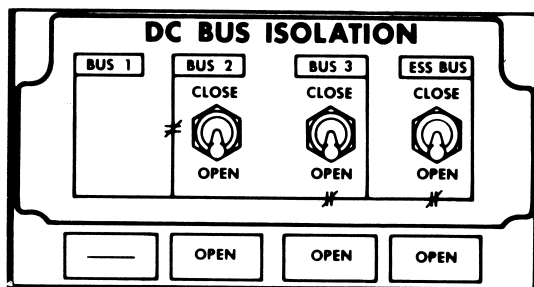
Switch is positioned to Gen. 1, 2, or 3, AC power is supplied directly from the respective generator and not the associated load bus.

DC POWER

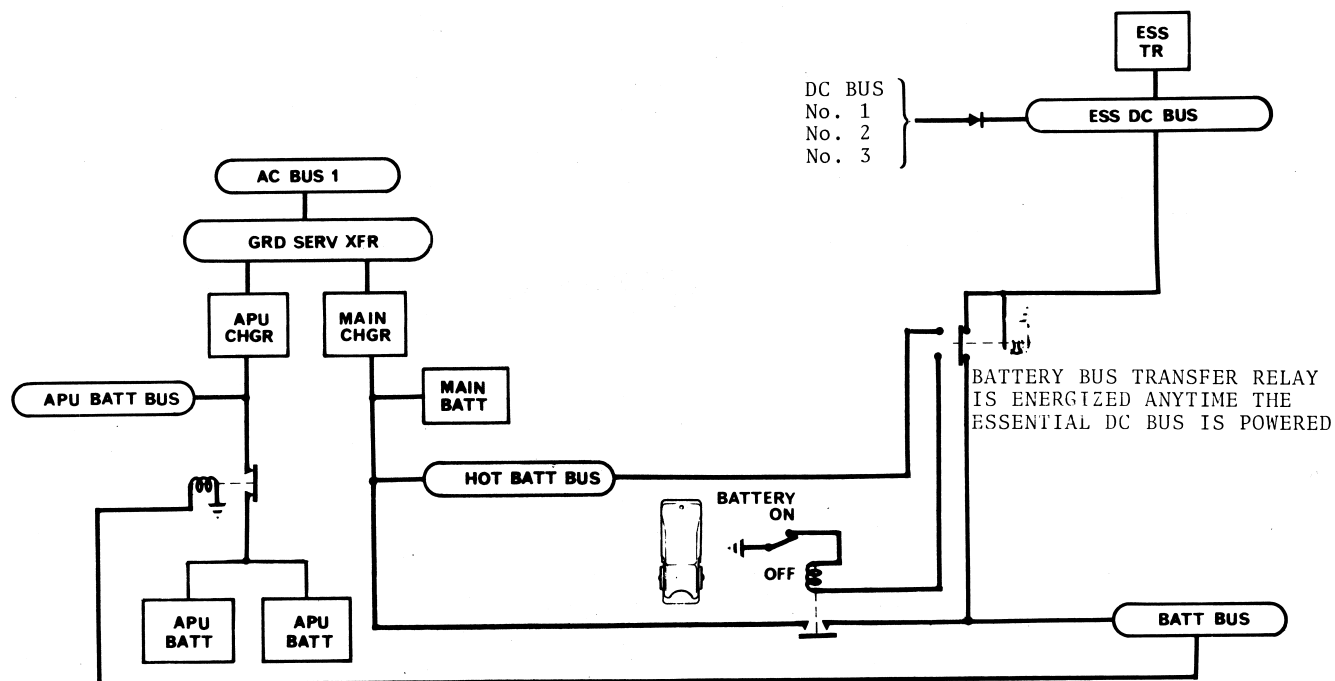


Twenty-eight volt DC bus power is provided by transformer-rectifier (TR) units. TR's No.'s 1, 2 and 3 are powered from AC Load Busses No.'s 1, 2 and 3 respectively. The Essential TR is powered from the Essential AC Bus which is normally powered by AC Load Bus No. 4.

The DC busses are normally connected in parallel through DC bus isolation relays but may be isolated into pairs or individual busses by DC Bus Isolation Switches.



BATTERY POWER



The aircraft is equipped with one main and two APU 24V lead acid batteries. When the main battery is "ON" and the "ESS DC" Bus is de-energized, the main battery and the two APU batteries are connected to their respective busses.

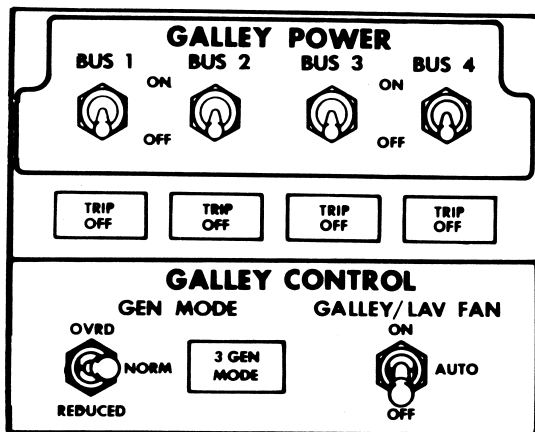
The battery bus is automatically transferred from the main battery to the Essential DC Bus when the Essential DC Bus is powered. When this occurs, the main battery is maintained in a standby mode ready to power the battery bus should the Essential DC Bus fail for any reason.

The main and APU batteries are maintained in a fully charged state by individual battery chargers.

STANDBY AC AND DC BUSSES

Standby AC and DC Busses are normally powered by the respective Essential AC and DC Busses. If an Essential DC power failure occurs, the standby busses are switched to battery power. The Standby DC Bus is then powered directly from the main battery and the Standby AC Bus is powered from a static inverter which receives its inputs from the main battery.

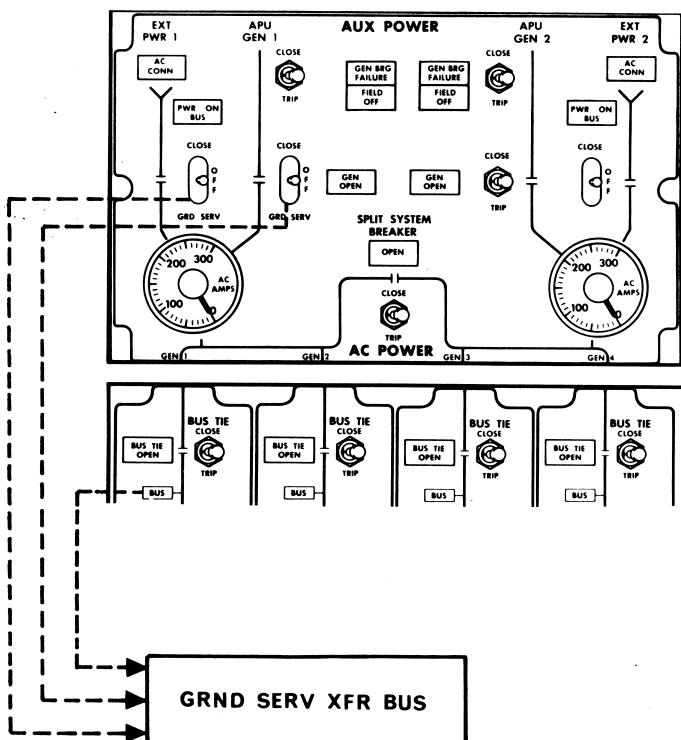
GALLEY POWER



Galley Busses 1, 2, 3 and 4 are powered by the respective AC Load Busses. Switching is provided to disconnect the galley busses from their power source. Galley Busses 1 and 3 power the forward galley, and Busses 2 and 4 power the aft galley.

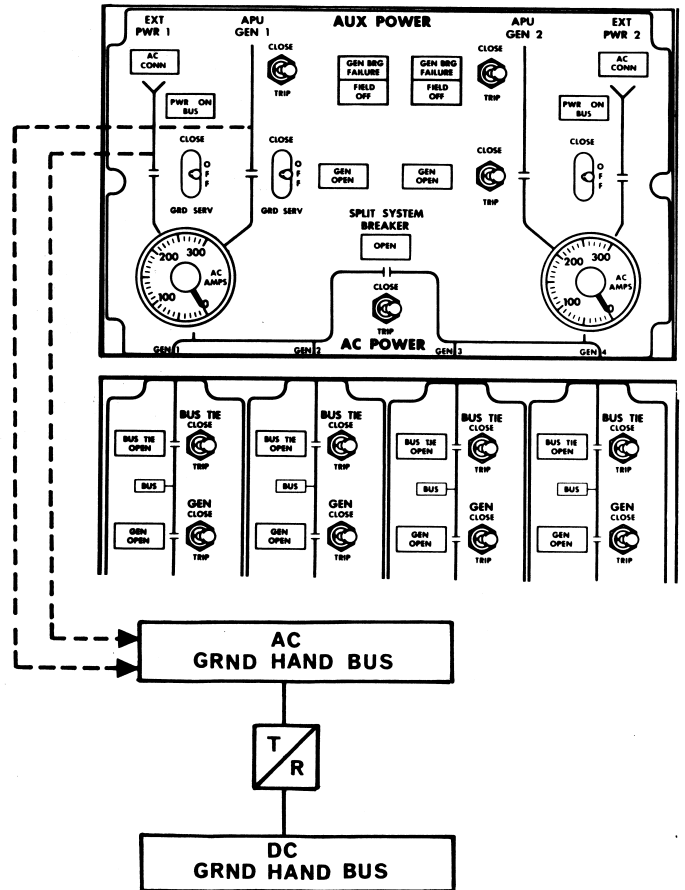
The Galley Control Warning light and three position switch provide the capability to monitor and control total amount of electrical power available to the galleys.

GROUND SERVICE TRANSFER BUS



The Ground Service Transfer Bus powers some ground servicing lights, electrical outlets, and the battery chargers for both the main and APU batteries. The Ground Service Bus will receive power from the No. 1 AC Load Bus anytime the No. 1 AC Bus is powered, either on the ground or in the air. On the ground with no power available to the No. 1 AC Bus, the Ground Service may be powered by selecting the "GND SERV" position of either the External Power No. 1 Breaker or No. 1 APU Power Breaker.

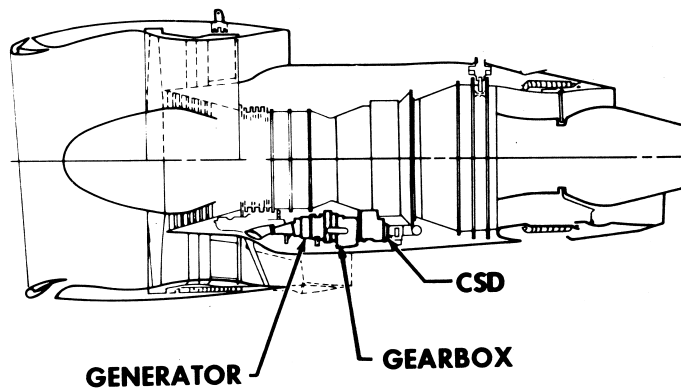
GROUND HANDLING BUS



The Ground Handling Bus powers such items as ground servicing lights, refueling valves, cargo doors, cargo handling equipment and the No. 4 electric hydraulic pump. This bus is powered only on the ground and can be powered by External Power No. 1 or the No. 1 APU Generator. External Power No. 1 has priority in supplying the ground handling busses; an operating Ext Power 1 source needs only to be plugged into the aircraft to provide this power. (AC Connect light illuminated.)

With no "EXT PWR 1" available, the Ground Handling Bus will be powered by "APU GEN 1" if the associated field switch is closed.

ENGINE DRIVEN GENERATORS



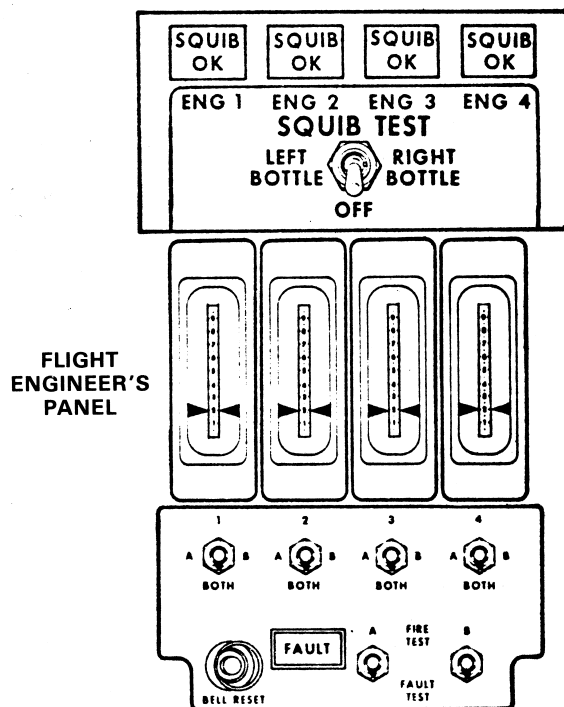
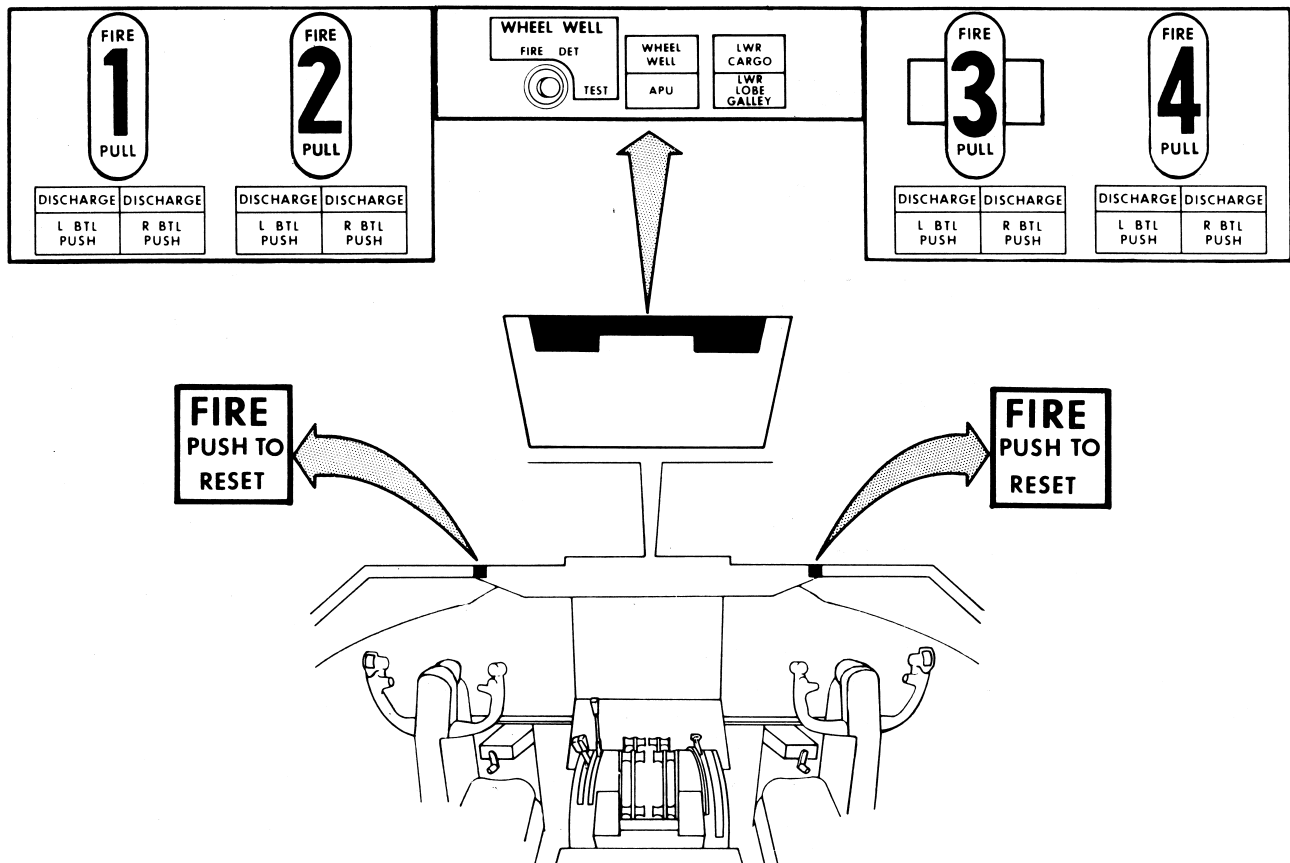
A Constant Speed Drive (CSD) mounted on each engine is used to convert variable engine speed input to a constant (8000 RPM/400 Hz) output. Each CSD is a complete self contained unit consisting of oil supply, cooler, instrumentation and disconnect. If the CSD is disconnected it can only be reset on the ground.

CONDITION: AIRPLANE ON GROUND, POWER OFF

A Main Deck Cargo Handling Bus has been added to the 747 freighter. It provides power to main deck cargo loading, door operation, etc. It can be powered by APU Generator No. 2 (with the field switch closed) or External Power No. 2 (when “AC CONN” light illuminated). External power has priority when both power sources are available.

FIRE DETECTION & PROTECTION

ENGINE NACELLE



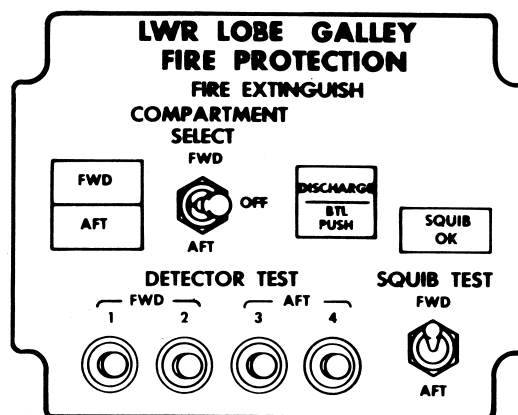
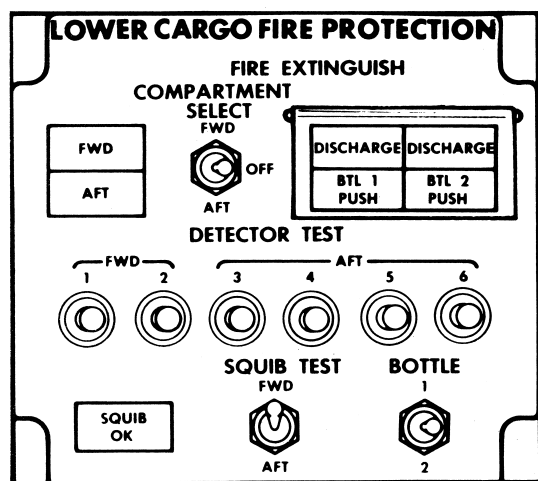
Nacelle fire detection is provided by dual detector loops within each nacelle. Fire warning indication and control consist of a cockpit fire warning bell, fire warning lights and a nacelle fire detection module at the F/E's panel. Fire protection is provided by engine fire handles and bottle discharge switches on the pilots' Overhead panel.

Two fire extinguisher bottles are located within each engine strut. A squib test panel is provided to test the continuity of the bottle squibs.

Nacelle temperature indicators indicate relative temperature levels sensed by the loops within each engine nacelle. Loop selector switches are also provided for each nacelle. In the BOTH position, both A and B detector loops are required to initiate a fire warning. In either the A or B position only the selected loop can initiate a fire warning.

Red discharge disks, one for each extinguisher bottle are located on the right side of each engine strut. If disks are ruptured or missing the extinguisher bottle may have thermally discharged.

LOWER CARGO AND GALLEY

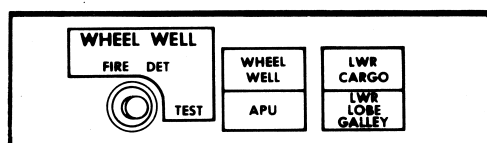


Smoke detectors are installed in the forward and aft lower cargo compartments for fire detection. Two fire extinguishing bottles are provided. They may be discharged one at a time into the selected compartment. The No. 1 bottle has a larger capacity and should be discharged first. The No. 2 bottle provides a second discharge to extend the effective time of extinguishing action.

These fire extinguishing bottles are not installed on some freighters. On these freighters, a lower cargo fire is extinguished by depressurizing the airplane.

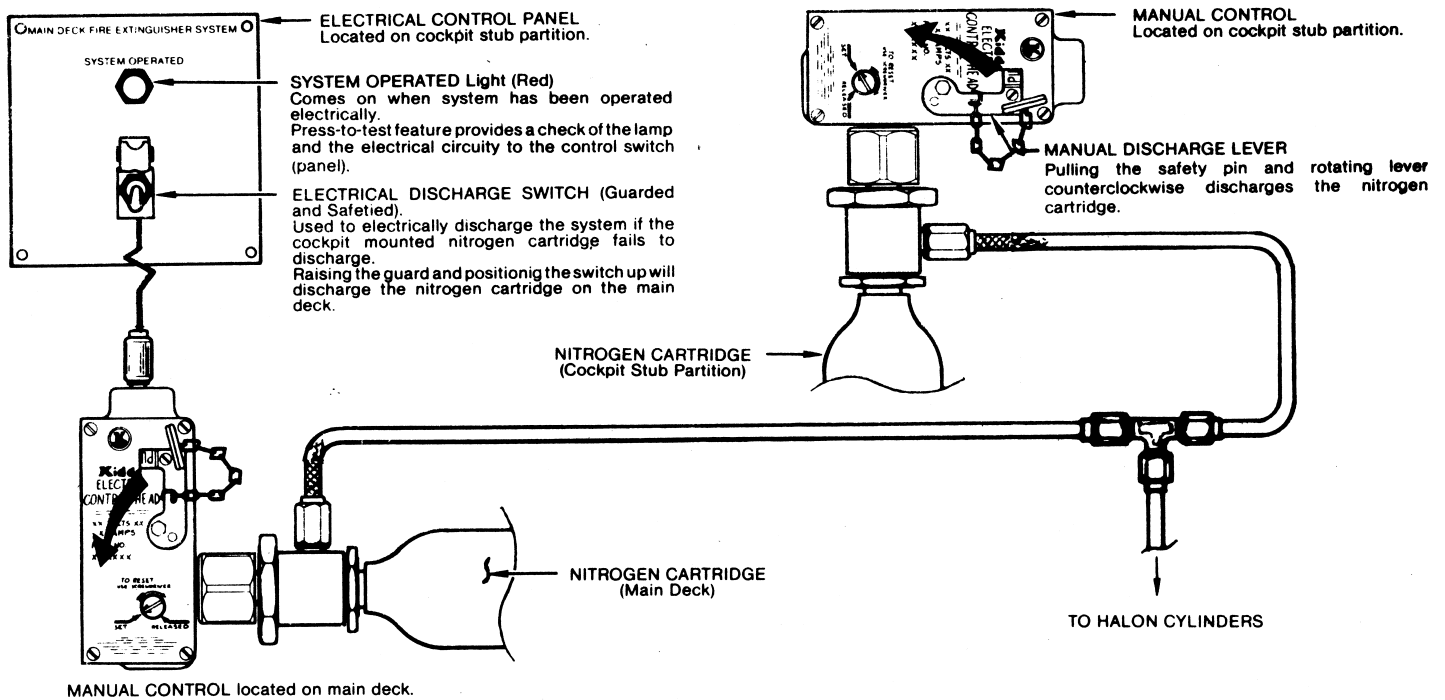
Lower lobe galley fire detection is provided by smoke detectors located in each galley. One fire extinguishing bottle is installed and may be discharged from the F/E console into either the forward or aft galley.

WHEEL WELL FIRE DETECTION



Fire detector loops are provided in each of the main landing gear wheel wells. A fire or overheat condition in one of the wheel wells will initiate a fire warning in the cockpit.

FREIGHTER



On 747 freighters a Main Deck fire detection and protection system is provided.

Main cargo deck fire detection is divided in 5 zones. A vacuum system draws main cargo deck air through dual smoke detectors. Each fire detector has the capability of activating the fire warning bell and appropriate lights in the cockpit area.

Two large cylinders of fire extinguishant are located on the sidewall just forward of door 1L. The bottles

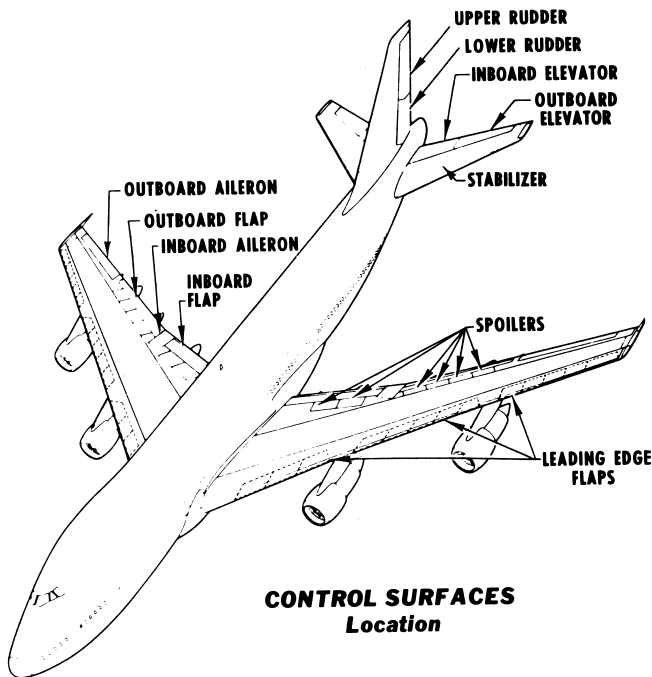
are discharged simultaneously into manifolds along the ceiling centerline. The cylinders may be discharged by:

- Nitrogen cartridge in the cockpit.
- Electric actuator in the cockpit.
- Nitrogen cartridge at the cylinders.

These cylinders are not installed on some freighters. On these freighters, a main deck fire is extinguished by depressurizing the airplane.

Additionally, there is one dry chemical extinguisher with an extension wand located adjacent to the main deck extinguishers.

FLIGHT CONTROLS



All flight controls on the 747, except for the leading edge flaps, are hydraulically powered. No manual (mechanical) reversion exists. Hydraulic systems 2 and 3 are the primary power sources to the flight controls; however, system redundancy is such that even if systems 2 and 3 are inoperative, all primary flight controls, ailerons, elevators and rudders can be operated with power from hydraulic systems 1 and 4. Control forces are the same regardless of speed, CG, or gross weight. Control system feel forces are generated artificially in all axis.

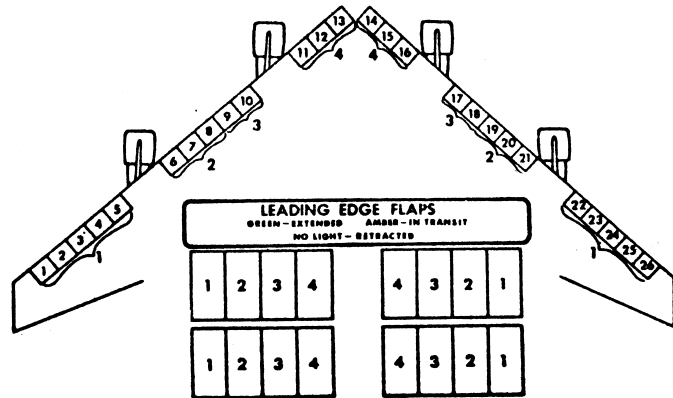
Lateral control is accomplished by using the inboard and outboard ailerons and flight spoilers. At low speeds, with the flaps extended, both inboard and outboard ailerons as well as flight spoilers are utilized. As flaps are retracted above position one, the outboard ailerons are electrically locked out.

Pitch control is provided by inboard and outboard elevators and a moveable stabilizer. The pilot's control columns hydraulically position the elevators. Stabilizer movement to unload elevators is provided by:

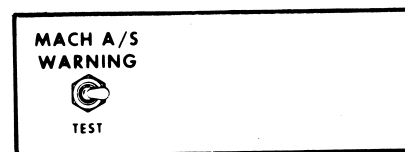
- Electric trim switches on the control wheel.
- Manual trim levers on the Pedestal.
- Automatically by the Autopilot.

Yaw control is provided by upper and lower rudders controlled by the rudder pedals and augmented by a full time yaw damper.

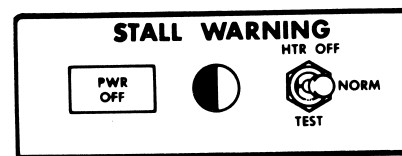
Hydraulically powered inboard and outboard trailing edge flaps with asymmetry protection are provided. A flap protection system is available to shut off hydraulic trailing edge flap power when the flaps move without the flap lever being repositioned. Alternate flap operation utilizes electric power. Asymmetry and flap protection are not available when using the alternate means of operation. Dual needle flap position indicators are provided for both the inboard and outboard flaps.



Four groups of leading edge flaps on each wing are normally powered by the pneumatic system and are programmed by the trailing edge flaps. As the trailing edge flaps reach position 1, groups 2 and 4 leading edge flaps extend. As the trailing edge flaps approach position 5 the remaining groups 1 and 3 extend. Extension or retraction of the leading edge flaps may be accomplished by using the alternate electric flap system.



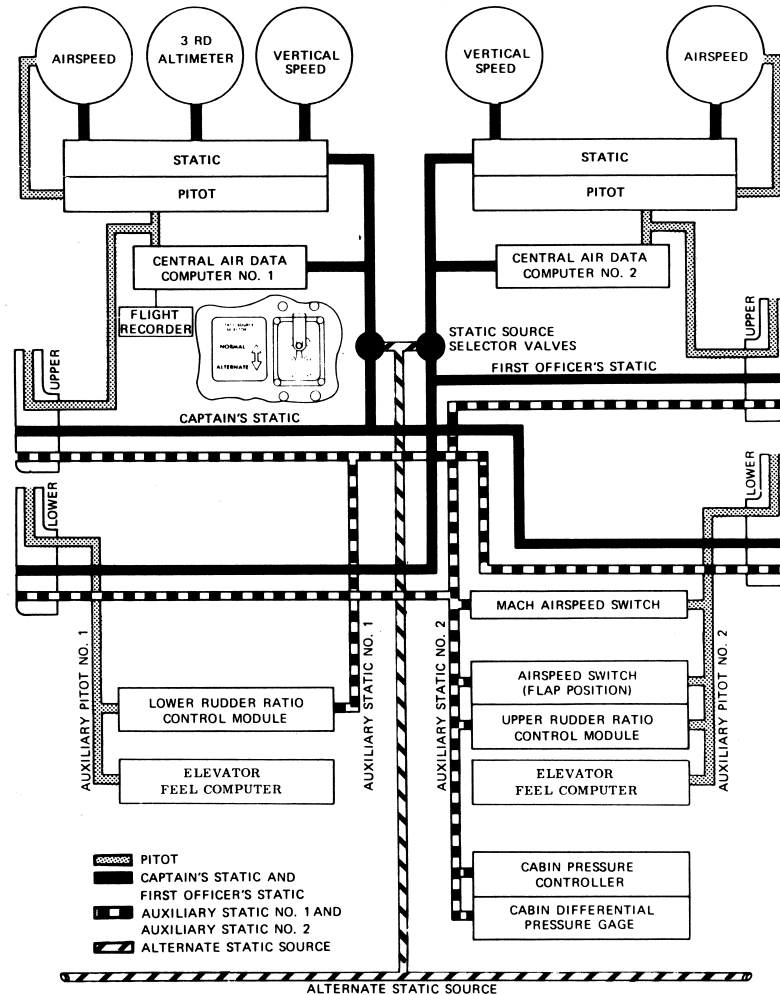
A Mach Airspeed Warning Ssystem sounds a warning (beeper) in the cockpit whenever airspeed exceeds Vmo.



A stall warning (column shaker) is active in flight once the nose gear leaves the runway.

PITOT STATIC

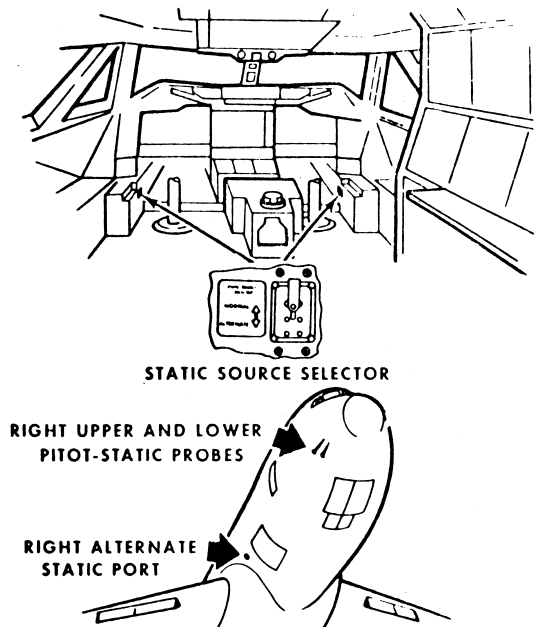
FLIGHT INSTRUMENTS



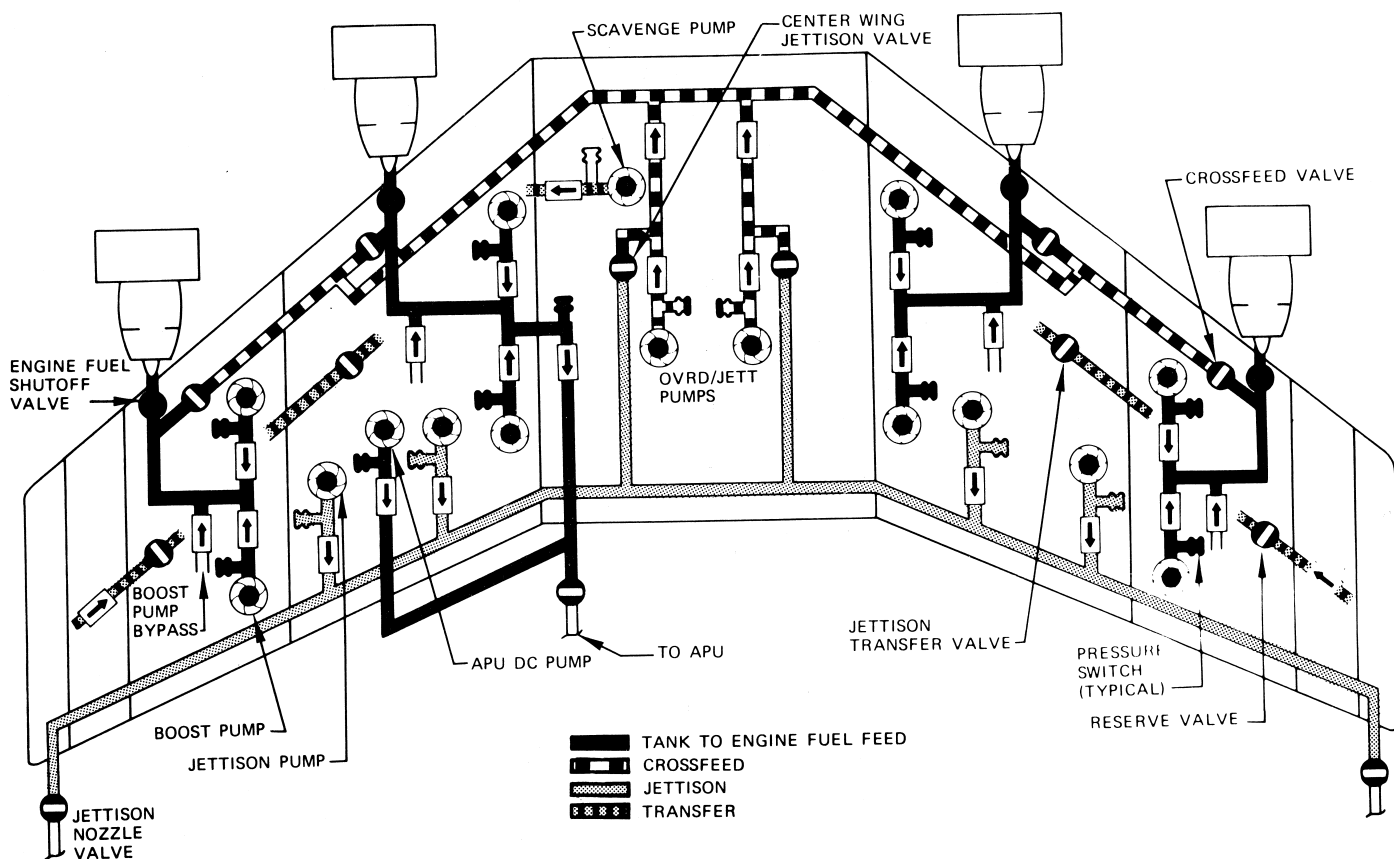
Four pitot static probes, two on each forward side of the airplane and two alternate static ports, one on each side forward of the wing leading edge are provided. The upper pitot static probes provide for the Captain's and F/O's pitot static instruments and No. 1 and 2 Central Air Data Computers (CADC's). Static sources on opposite sides of the aircraft are cross-connected to provide for more accurate indications. The lower pitot static probes provide signals to other systems which require airspeed and static references.

An alternate static source provides backup source to the Captain's and F/O's static systems.

Two temperature probes, one mounted just forward of each of the pilot's windshields, provide indication of static air temperature (SAT) and total air temperature (TAT). All pilot/static and temperature probes are anti-iced electrically.



FUEL



All fuel is contained in tanks located in the interspar area of each wing and in the center wing section of the fuselage. The tanks are designated No.'s 1, 2, 3 and 4 main tanks, No.'s 1 and 4 reserves and the center wing tank. Boost pumps within each main and center wing tank can feed fuel directly from tank to engine or to any or to all engines through the crossfeed system. Fuel in No.'s 1 and 4 reserve tanks gravity feeds into the adjacent main tanks 1 and 4. Above gross weights of 600,000 pounds fuel must be retained in the reserve tanks to improve structural strength.

Jettison pumps are housed in main tanks 2 and 3. Override/jettison pumps in the center wing are used to pump center wing tanks fuel to the crossfeed manifold or to the jettison manifold. Fuel can be dumped down to the standpipe level of 7,000 pounds in each of the main wing tanks. The override/jettison pumps in the center wing tank can take the fuel down to about 2,000 pounds. During jettison operations,

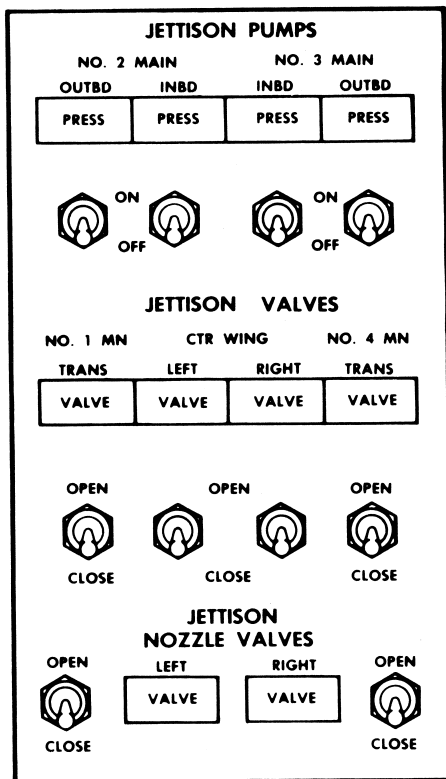
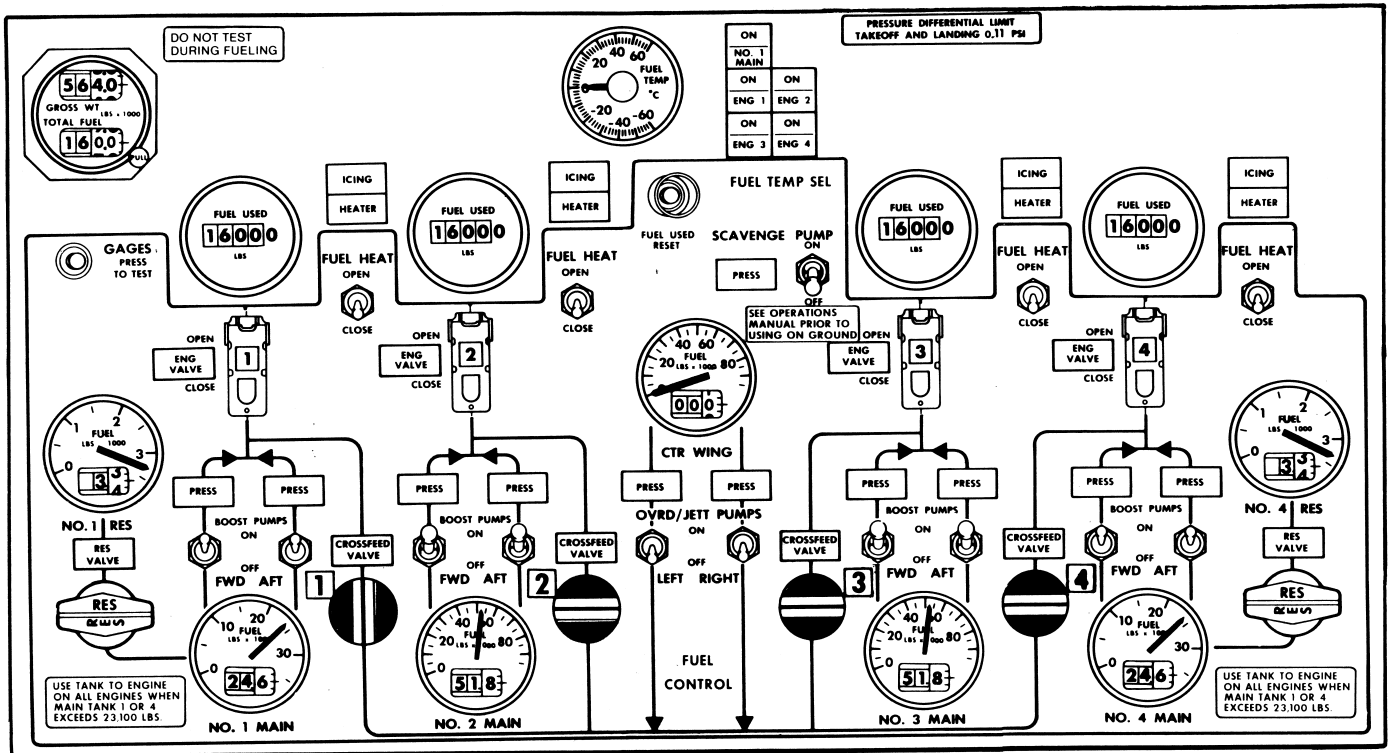
fuel in main tanks 1 and 4 gravity feeds into adjacent main tanks 2 and 3 provided appropriate jettison valves are open.

APU fuel is normally provided by main tank No. 2 through either the aft main boost pump or the APU DC fuel pump. APU fuel may be taken from any tank through the crossfeed system.

Surge tanks in each wing tips provide expansion chambers for excess fuel due to overfilling or thermal expansion.

Fueling and defueling is provided by two receptacles at each of two fueling stations, one in each wing. Fueling control is from the left wing fueling station. Fueling uses the same manifold as the jettison system.

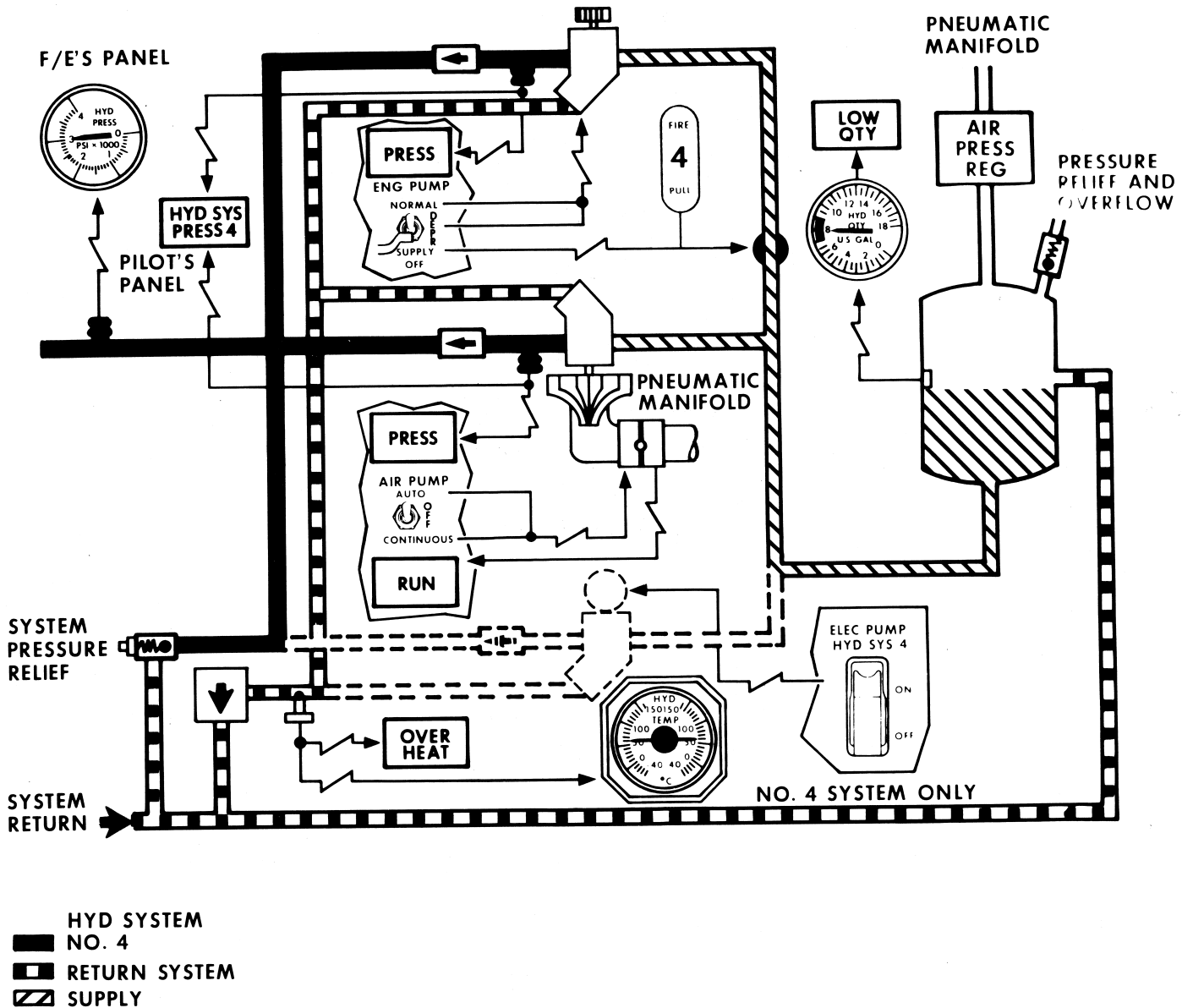
A fuel heat system utilizing engine bleed air is provided for each engine fuel system.



The fuel control panel is located on the lower center of the F/E console. Fuel jettison controls are located on the right side of the F/E console.

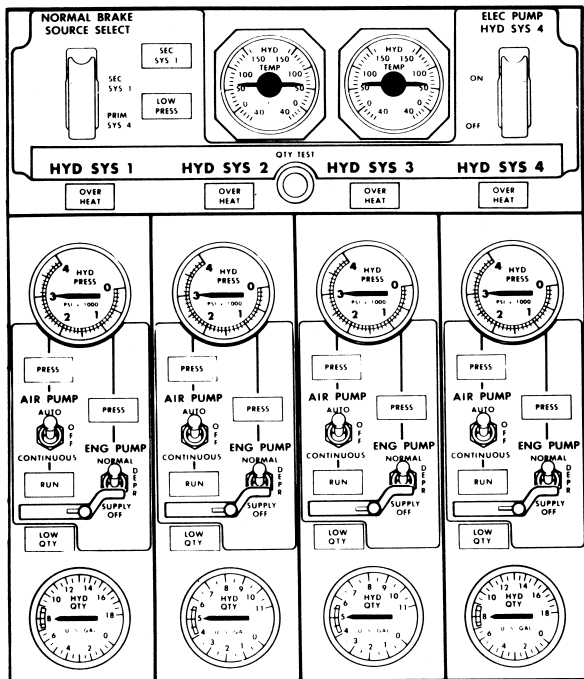
In addition to fuel quantity gauges for each tank, there is a FUEL USED indicator for each engine and a TOTAL FUEL/GROSS WEIGHT indicator. The TOTAL FUEL indicator automatically totals the fuel contained in all tanks. The GROSS WEIGHT indicator must be set by the F/E. Gross weight indication will automatically decrease as fuel is used.

HYDRAULICS

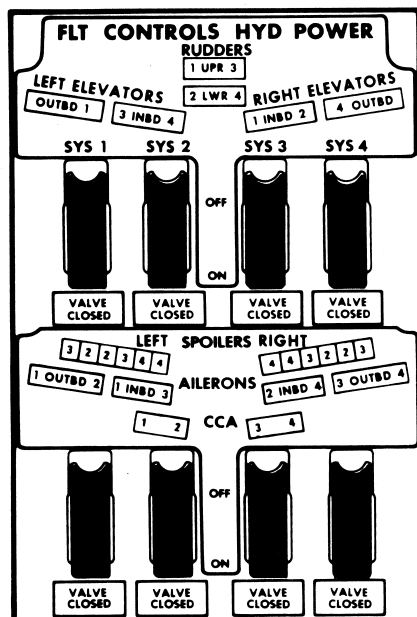


Hydraulic power is supplied by four independent systems. Each incorporates an engine driven pump and an air driven pump. In addition No. 4 system has an electric pump to provide hydraulic brake pressure during towing and push-out with the engines static. Hydraulic systems 2 and 3 are, primarily, flight control power sources. And while systems 1 and 4 are

assigned to flight controls also, they have other primary uses. The number 1 system provides pressure to the inboard trailing edge flaps, and inboard gear including nose and body gear steering. Hydraulic system 4 is assigned to the outboard trailing edge flaps and the wing gear and normal brakes.



The air driven hydraulic pumps operate to supplement the engine driven pumps during high demand periods. When activated the air driven pumps will continue to operate for a period of time to prevent excessive cycling of the pump after system pressure has been restored. Air for ADP operation is from the pneumatic manifold.



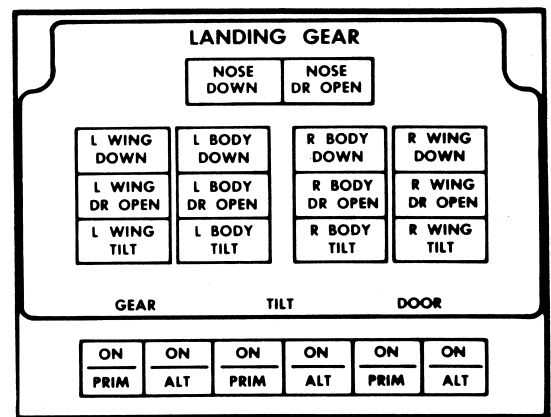
Placards on the pilots' overhead panel depict hydraulic system assignment to power the flight controls. The hydraulic switches and valve closed lights on this module are for maintenance use only.

LANDING GEAR

The 747 landing gear consists of left and right wing gear, left and right body gear and a nose gear. Each of the main gear is equipped with four wheels per truck for a total of sixteen main gear wheels. The nose gear is dual wheel. All gear control valves are actuated simultaneously by movement of the landing gear handle on the pilot's center panel.

The main gear trucks must be in the tilted position before retracting in order for the gear to fit into the wheel well bays.

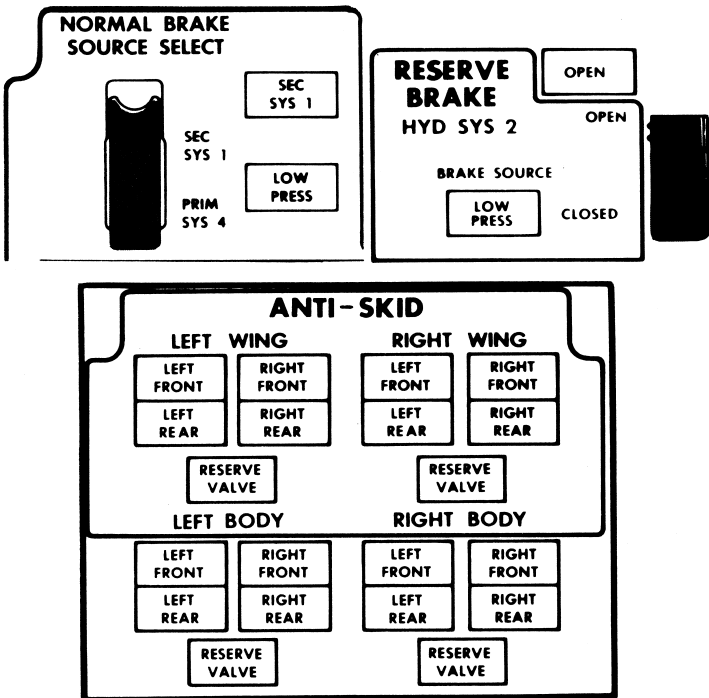
Dual landing gear sensors, primary and alternate, indicate gear position, gear truck tilt and gear door position.



Gear tilt switches provide air/ground sensing on the 747 much as squat switches do on other aircraft.

The nose wheel is steerable up to 7° with rudder pedals and to 70° with pilot's tillers. When armed, the body gear steering is automatically actuated when the nose gear is turned in excess of 20°. The maximum body gear steering angle is 13°.

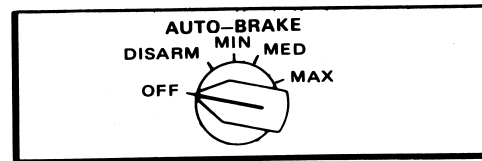
BRAKES



The only selectability between hydraulic systems is in the pressure source used for wheel brakes. Normally system 4 provides braking power for all sixteen main wheels, with system 1 as the secondary source. A reserve brake system uses hydraulic power from system 2; it provides emergency backup for normal brakes.

Normal brakes, using hydraulic system 4 or 1, provide full anti-skid protection including touchdown protection. Touchdown protection signals a full brake release through the anti-skid valve until the tilt switches indicate the aircraft is on the ground and the wheel sensors indicate wheel rotation. Touchdown protection is not available on the reserve brake system. In the reserve system anti-skid sensors are available to each axle pair of wheels on a truck instead of to each wheel.

AUTO BRAKES



The auto brake system automatically applies brakes after landing. The system is armed before landing by selecting the MIN, MED or MAX deceleration level. Selection is determined by runway length and braking conditions.

On landing and after wheel spin up, the auto brake system begins to apply symmetrical braking to control airplane deceleration. The system will disarm whenever:

- Either brake pedal is applied.
- Take-off thrust is applied while airplane is on the ground.
- Anti-skid is off or a fault detected.
- Auto brake fault is detected.
- Throttles are not closed within 3 seconds after touchdown.

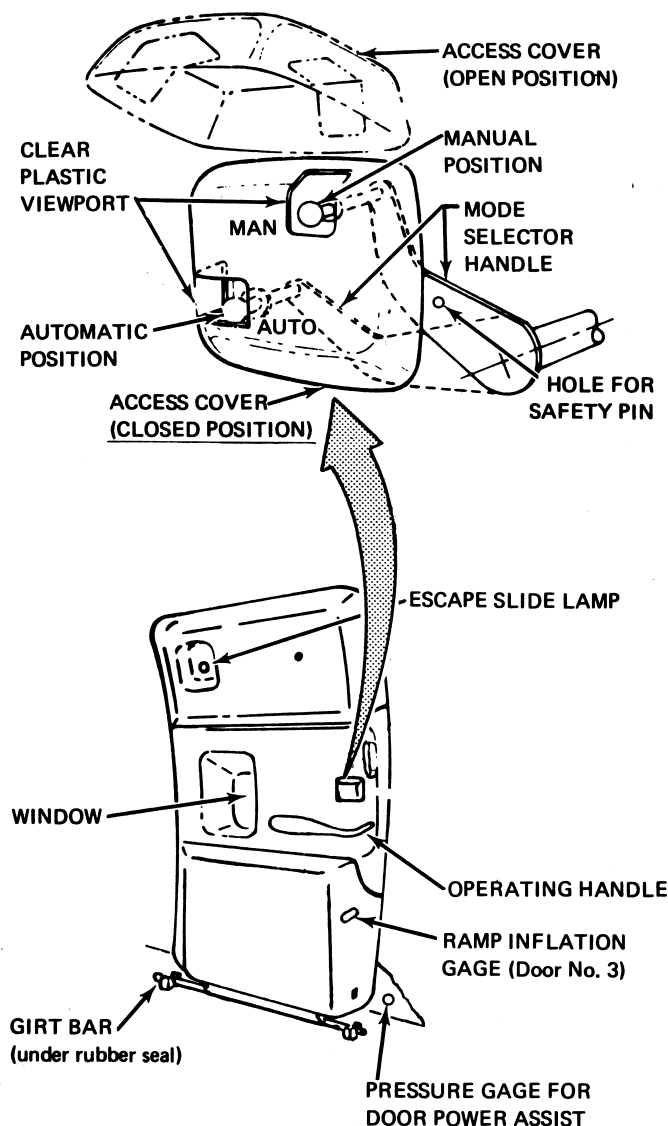
Auto brakes are not available to the reserve brake system.

MISCELLANEOUS

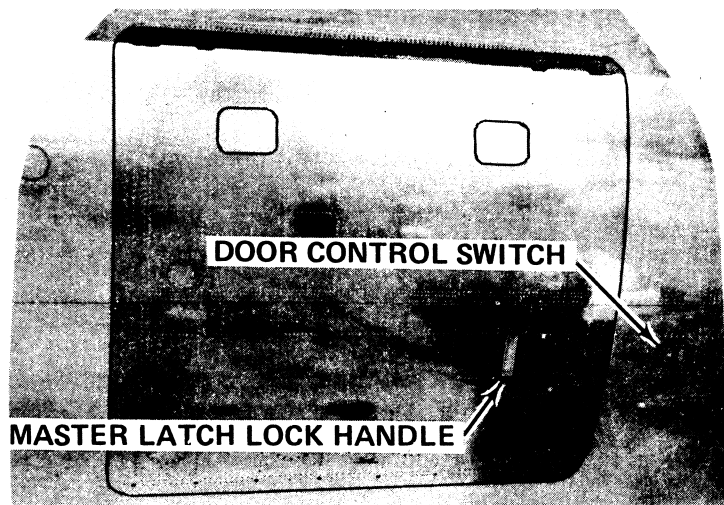
LOWER LOBE GALLEYS

AA aircraft are equipped with 2 lower lobe galleys. The forward galley occupies the rear portion of the forward cargo compartment. The aft galley occupies the forward portion of the aft cargo compartment. All ovens are located in the lower lobe galleys. Personnel and food carts are moved from the galleys to the main deck service areas by means of a personnel and a food cart lift.

MAIN ENTRY DOORS



The main entry doors have 2 modes of operation: manual for normal entry and exit and automatic for emergency exit. The mode of operation is selected from inside the aircraft by positioning the Mode Selector Handle. If a door is opened from the inside while in the AUTO position, automatic deployment of the escape slide/raft will occur. Opening a door from the outside will trip the Mode Selector Handle to MANUAL.



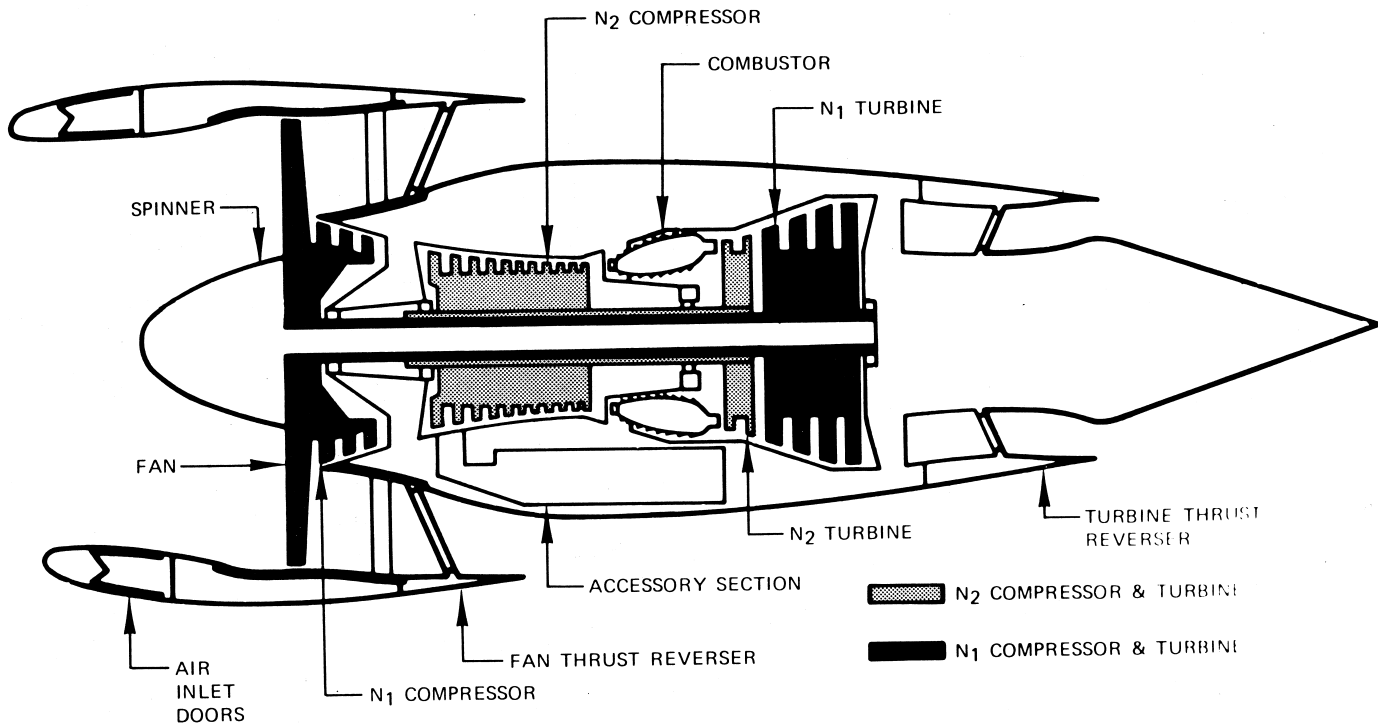
The forward and aft main cargo doors are operated electrically. To open, release the Master Latch Lock Handle by pressing a trigger on the handle and hold the Door Control Switch to OPEN.

NAVIGATION

American Airlines' 747's have one Litton Inertial Navigation System (INS) installed. The INS is completely independent of inputs external to the aircraft. It requires only an electrical power supply and TAS input from sources inside the aircraft. After being programmed from a departure point to a destination point the INS will provide great circle course information based on True North. In addition to the navigation information provided, the INS provides gyro artificial horizon, stabilization for the compass system, AP/FD computers, Yaw Damper, Autothrottle, and Radar.

The INS provides two operational modes, NAV (navigation) and ATT REF (attitude reference). In the NAV Mode the INS provides both navigation information and a stabilized platform. In ATT REF the INS provides only the stabilization platform. On passenger airplanes, two Omega VLF Navigation Systems (ONS) are provided. ONS information may be displayed on the HSI and coupled to the Auto-Flight system. On freighters, ONS is not provided; INS information can be displayed on the HSI and coupled to the Auto-Flight system.

POWER PLANT

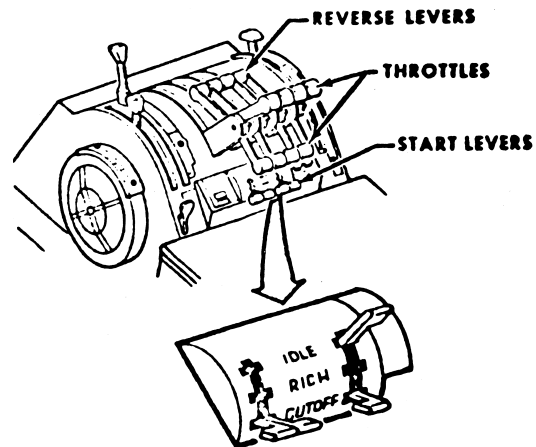


American Airlines' 747's are equipped with Pratt and Whitney JT9D-3A or JT9D-7AH engines. The JT9D is a forward fan, twin spool axial compressor type engine with a bypass ratio of 5:1. The fan delivers approximately 75% of the thrust. The low pressure compressor unit (N₁) consists of a single stage fan and a three stage compressor connected by a through shaft to a four stage turbine. The high pressure compressor unit (N₂) consists of an eleven stage compressor connected to a two stage turbine through concentric shafting. Variable stators, automatically positioned by fuel pressure, provide an adequate stall margin for engine starting, acceleration and low power operation.

There are two engine idle speeds; low (ground) idle is used during ground operation and during all flight operations except the approach and landing flaps extended to 25° to 30°; then the engines shift to high (flight) idle to facilitate engine acceleration for go around.

A thrust reverser system provides a means of reversing fan exhaust air. Monitor lights on the pilot's center instrument panel provide position indications of the thrust reversers during reverse thrust operation. The

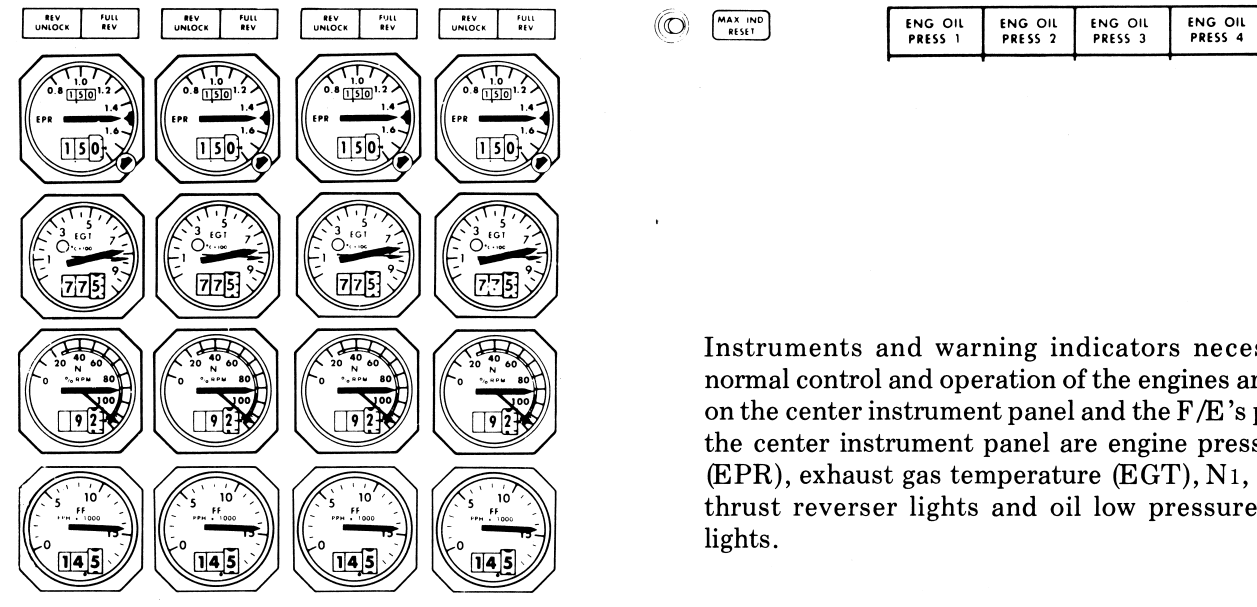
reverse levers are an integral part of the throttle system, and are actuated by pulling the levers up and aft.



The throttles have extensions for the Flight Engineer. Also, throttle switches are provided to disengage the Autopilot and Autothrottle systems.

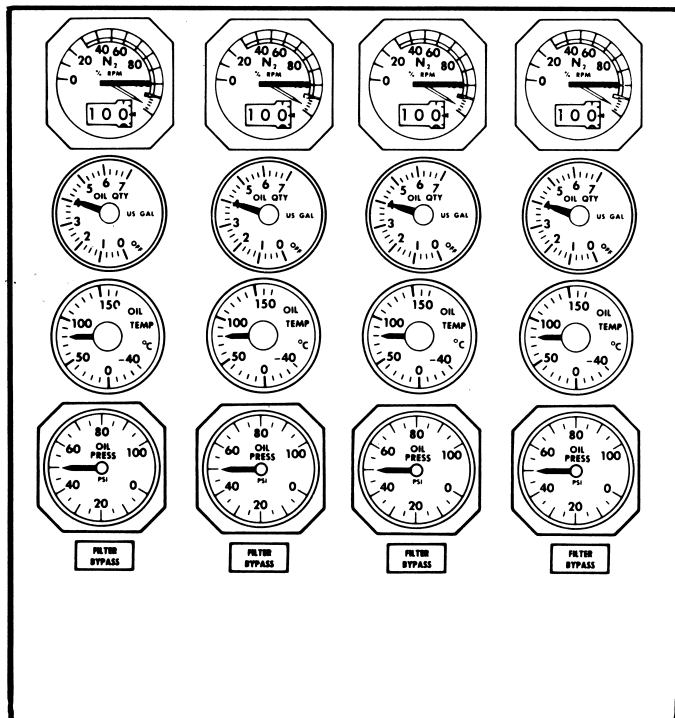
Engine start levers have three positions: CUTOFF, RICH and IDLE. The RICH position is used to start a cold soaked engine.

PILOTS CENTER INSTRUMENT PANEL



Instruments and warning indicators necessary for normal control and operation of the engines are located on the center instrument panel and the F/E's panel. On the center instrument panel are engine pressure ratio (EPR), exhaust gas temperature (EGT), N₁, fuel flow, thrust reverser lights and oil low pressure warning lights.

FLIGHT ENGINEERS PANEL



Instruments at the F/E panel are N₂, oil quantity, oil temperature, oil pressure, and a filter bypass warning light. The EPR, EGT, N₁, Fuel Flow and N₂ gauges have digital readouts. EGT, N₁ and N₂ have maximum indicator pointers.

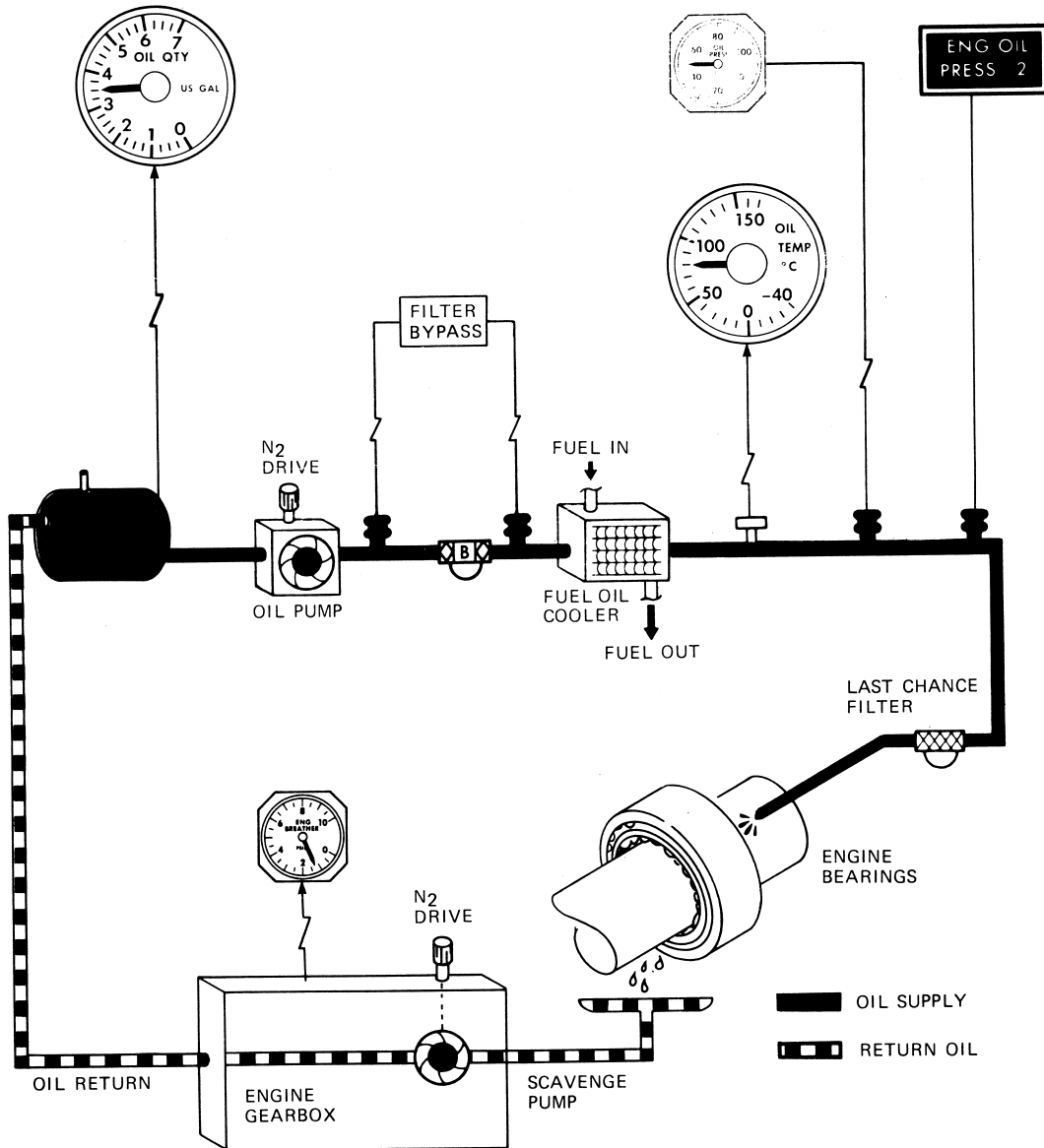
ENGINE START SYSTEM

The engine starting system provides a means of rotating the N₂ compressor to establish airflow through the engine. Dual independent ignition systems are 115V AC powered. A standby ignition is provided for use when only battery power is available.

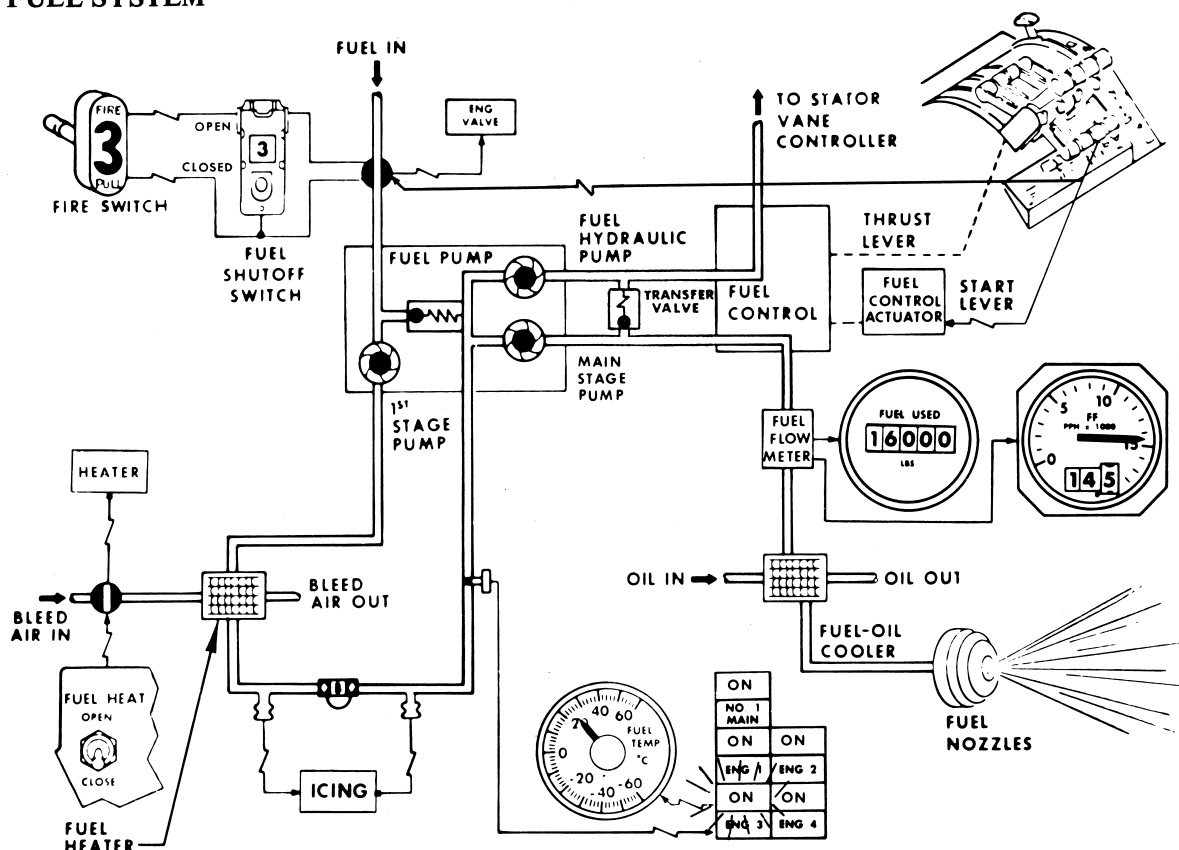
Air used to drive the starter is supplied through the pneumatic manifold from the APU, a ground start cart or by cross bleed from an operating engine. Manual override starts can be made in the event of an engine bleed or starter valve malfunction.

ENGINE OIL SYSTEM

Each engine contains an independent oil system that provides lubrication and cooling to engine bearings and gears. An engine driven oil pump forces oil through the main oil filter, a fuel oil cooler and the last chance filters to the bearings and gear box. If a filter should become clogged a bypass will open and permit unrestricted flow to the bearings. A filter bypass warning light illuminated warns of this condition.



ENGINE FUEL SYSTEM



Fuel flows from the tank to the engine through a fuel shutoff valve which is operated by the engine fire switch, the fuel shutoff switch and the engine start levers. After passing through a boost stage of the fuel pump, the fuel flows through the fuel heater and fuel filter to the two high pressure pumps. The main stage

pump furnishes fuel at high pressure to the fuel control unit, across a fuel oil cooler and to the fuel nozzles. The fuel hydraulic pump provides fuel under pressure as the hydraulic agent for stator vane operation.

RADAR

AA 747's are equipped with Bendix RDR-1F "X" band radar with weather painting and ground mapping capabilities. The Captain and First Officer each have scopes for presentation of radar data.

OXYGEN

American Airlines' 747's are equipped with three oxygen systems: the cockpit system, cabin system, and the portable O₂ system.

The cockpit system consists of two O₂ bottles in the forward cargo compartment and sweep on masks at the three crew positions. Conventional masks are available at the two Observer stations. A portable bottle with full face mask is located at the stub partition.

The cabin system consists of six O₂ bottles in the forward cargo compartment and individual continuous flow masks at each passenger service unit. The masks are presented automatically when cabin pressure altitude exceeds approximately 14,000 feet. The masks may be dropped electrically by a switch at the F/E console. On passenger aircraft this system may be reset at the flow control unit by use of a reset handle inside the main equipment center.

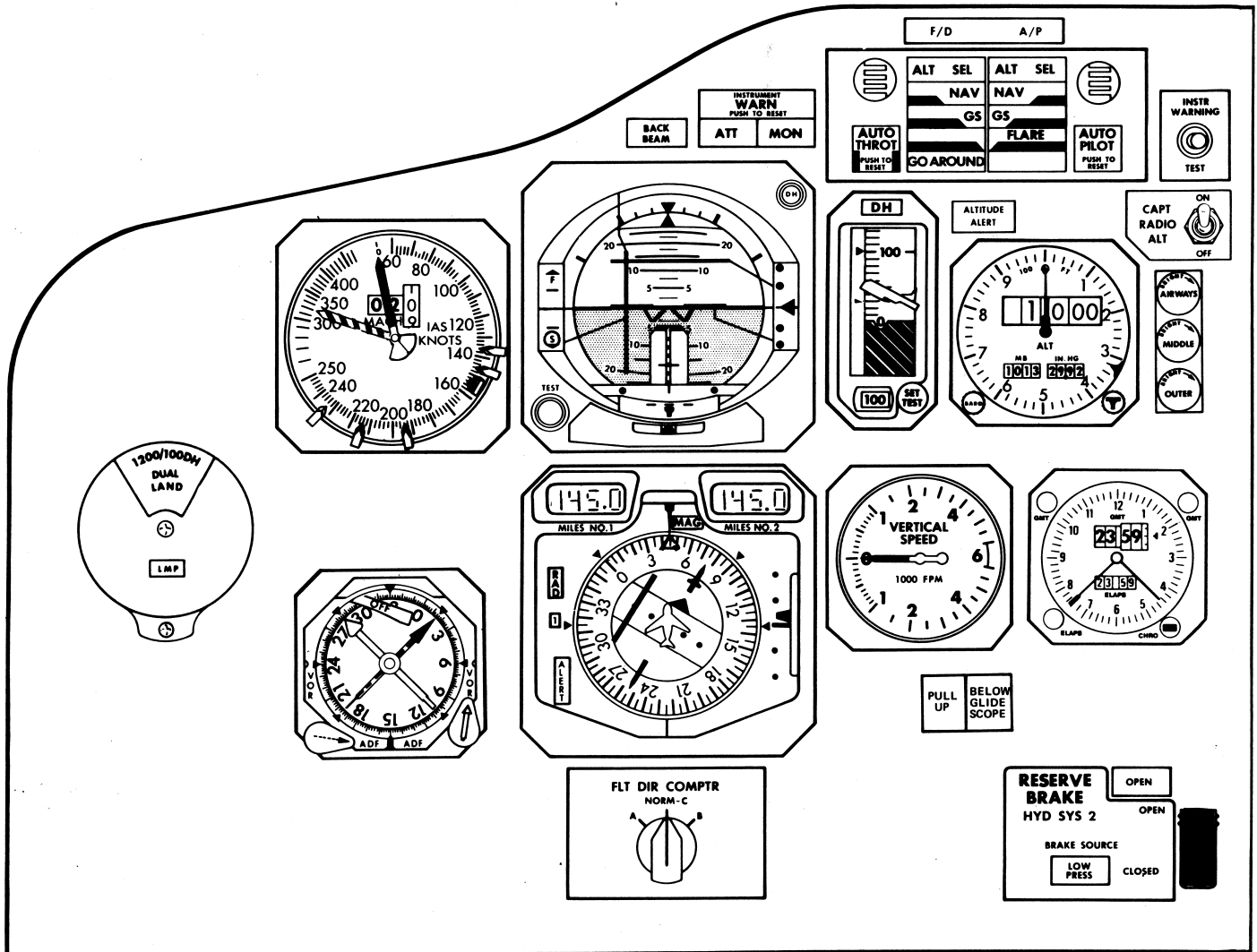
FREIGHTER

On the freighter there is only one oxygen bottle for passenger use. The oxygen reset handle has been removed and the flow control unit cannot be reset until after landing. Oxygen flow may be shut off at the individual PSU.

SECTION III

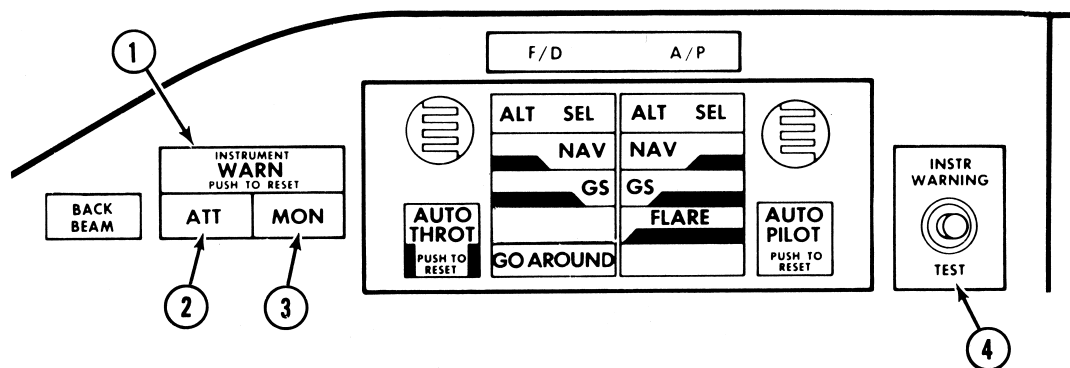
COCKPIT PANEL DESCRIPTION

This section contains a brief description of each instrument, control and light in the cockpit. Passenger aircraft will be described first followed by a supplement of freighter differences.



CAPTAIN'S INSTRUMENT PANEL

INSTRUMENT WARNING SYSTEM



1. INSTRUMENT WARNING LIGHT (Red)

Illuminates flashing when any of the following flags come into view: ATT, "Heading," GS (after capture), NAV (after localizer capture), and "Radio Altimeter" (below 1500' AGL). The light will also flash when the ATT lights are illuminated. Pushing the lightcap will extinguish the light and reset the system.

2. ATTITUDE COMPARISON WARNING LIGHT (Amber)

Both ATT warning lights will illuminate when a difference of approximately 5 degrees of pitch and/or roll exist between ADI's. The light will not extinguish until the differences are corrected; however, it will dim when the instrument warning light is pressed to reset.

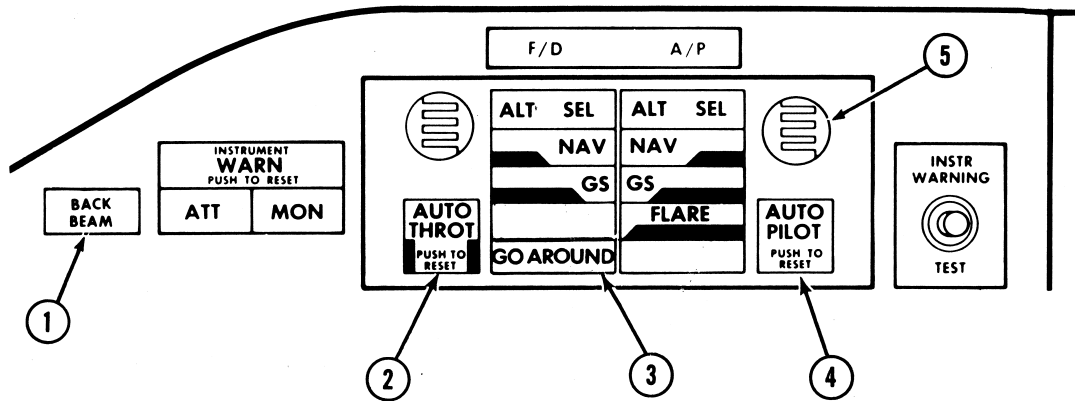
3. COMPUTER MONITOR WARNING LIGHT (Amber)

Illuminates when power is lost to the Central Instrument Warning System Computer and will remain illuminated until power is restored. Illumination is a warning to the pilot that he must monitor instruments for unwanted flags and attitude discrepancies. The flashing red instrument lights and attitude lights are inoperative when the monitor lights are illuminated.

4. INSTRUMENT WARNING TEST SWITCH

This switch, when pressed to test, will cause the ATT and MON lights to illuminate steady and both "WARN" lights to flash. Releasing the switch will extinguish the ATT and MON lights but the "WARN" lights will continue to flash until they are pressed to reset.

AUTOPILOT/FLIGHT DIRECTOR APPROACH PROGRESS DISPLAY



1. BACK BEAM LIGHT (Amber)

Illuminates when the Back Beam Mode is selected, indicating steering commands are directional when flying a back course ILS with the Flight Director.

2. AUTOTHROTTLE WARNING LIGHT (Amber/Red)

Illuminates steady amber when airspeed varies greater than 10 knots between actual and selected. It illuminates steady red when the maintenance computer self test switch is not in the "OFF" position. It flashes red when the autothrottle has disconnected. Push to reset the flashing red light. If extinguished, pressing the light will cause both autothrottle lights to flash red and when released the lights will extinguish.

3. FLIGHT DIRECTOR AND AUTOPILOT APPROACH PROGRESS DISPLAYS

The light function of the ALT SEL, NAV, and GS is the same for both F/D and A/P operation. The A/P lights are controlled by the A/P that is engaged in CMD. The F/D lights are controlled by the computer selected with the switch below the respective H.S.I.'s. The Flare light is an A/P function only, while the Go-Around light is a F/D function only. F/D amber lights will illuminate with the F/D switch ON and the

corresponding mode selected. Green capture lights illuminate when the respective signal is captured with exception of go-around. The go-around light comes on green when the palm-operated switch on No. 2 or No. 3 throttle is activated after glideslope capture. To test the amber lights, press the F/D Display panel; to test green and red lights, press the A/P Display panel.

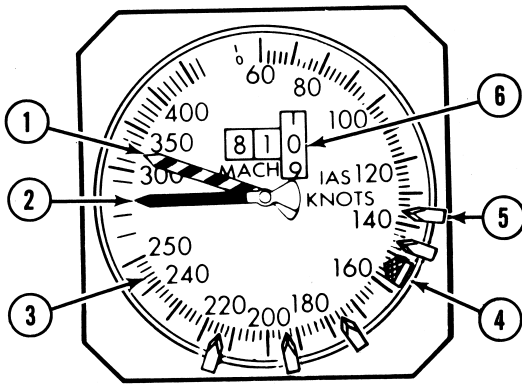
4. AUTOPILOT WARNING LIGHT (Amber/Red)

Flashing amber indicates that autopilot Land mode of operation has been selected and both autopilot switches are not in command. It illuminates steady red indicating an invalid signal from a subsystem or the maintenance self-test switches are out of the "OFF" position. Flashing red indicates the autopilot has disengaged. Disengagement is accompanied by an oral warning (wailer sound). The wailer and the flashing lights will continue operating until the warning system is reset by pressing on the light (hold momentarily) or the autopilot disengage button on the control wheel.

5. PHOTO ELECTRIC CELL

Dims approach progress display automatically to adjust for cockpit light conditions.

MACH/AIRSPEED INDICATOR



1. MAXIMUM OPERATING AIRSPEED POINTER
Displays VMO.

2. INDICATED AIRSPEED POINTER

3. INDICATED AIRSPEED SCALE

4. COMMAND AIRSPEED BUG (Red)

Indicates airspeed selected for reference or autothrottle operation as set on the Autothrottle Speed Selector.

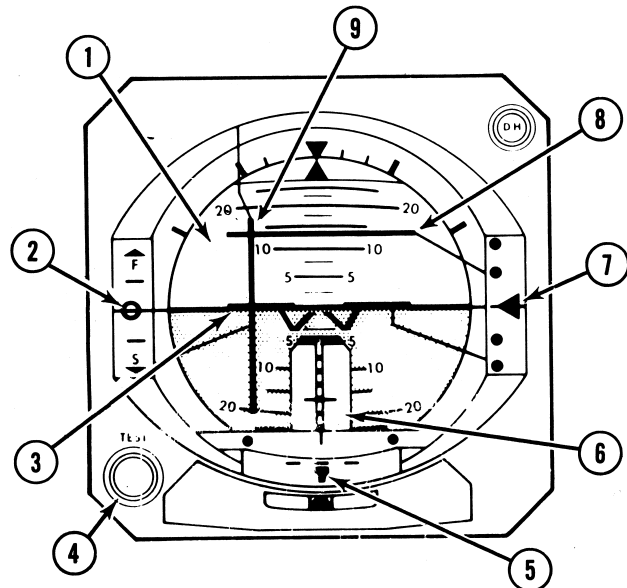
5. AIRSPEED BUGS (5 White)

Set for speed references.

6. MACH INDICATION

Indicates Mach Airspeed on rotating drums. A yellow flag in the window covers indication when unreliable.

ATTITUDE DIRECTOR INDICATOR (ADI)



1. ATTITUDE HORIZON

A sphere display, showing attitude in pitch and roll axis, referenced to the appropriate Attitude System.

2. AUTOTHROTTLE FAST – SLOW INDICATOR

Controlled by autothrottle computer and indicates speed deviation in relation to the selection setting with the Autothrottle Engage Switch “ON” or “OFF”.

3. FIXED AIRPLANE REFERENCE

Displays attitude references in relation to the Horizon Scale and Bank Angle Scale.

4. TEST SWITCH

When pressed, the Attitude Sphere will indicate a 20° right bank and 10° pitch up (\pm tolerances), and the ATT flag will come into view along with the warning system being activated.

5. RATE OF TURN AND SLIP INDICATORS

Registers rate of turn inputs from the Yaw Damper Rate Gyros. Loss of Upper Yaw Damper will bias the Captain's rate of turn indication out of view. Loss of the Lower Yaw Damper will bias the F/O's out of view.

6. LOCALIZER COURSE DEVIATION INDICATOR AND RISING RUNWAY SYMBOL

Appears when receiving a valid ILS signal and will start to rise to meet the Fixed Airplane Symbol at 200 feet AGL. It will be out of view when an ILS frequency is not tuned, the ILS signal is unreliable or Back Beam is selected. Full scale deflection corresponds to 1/2 dot on the HSI.

7. GLIDE SLOPE POINTER

Shows deviation from the center of the glide slope beam. It is out of view when not tuned to an ILS frequency. Two dots on the scale indicates approximately a 400 foot altitude deviation at the Outer Marker.

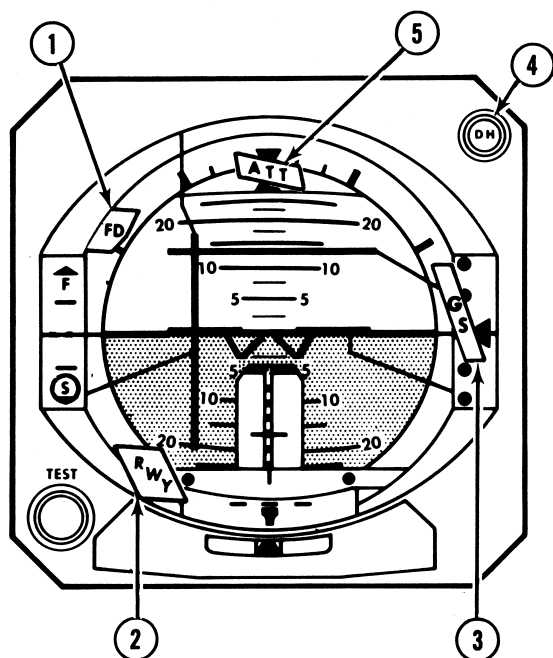
8. PITCH COMMAND BAR

Displays pitch commands to attain or maintain the desired altitude, IAS, glide slope, or manually selected attitude. In F/D Go-Around mode it will give a 12° pitch up command. It is out of view with the F/D switch OFF, Back Beam selected or pitch commands invalid.

9. ROLL COMMAND BAR

Displays roll commands to maintain the desired VOR/LOC, Heading or ONS/INS track. Referenced to the Heading mode when not captured. It is out of view with the F/D Switch "OFF" or when roll commands are invalid. In F/D Go-Around mode it will give a wings level command.

ADI FLAGS



1. FLIGHT DIRECTOR WARNING FLAG

Indicates a fault in the F/D computer.

2. RWY WARNING FLAG

Indicates the Localizer or Radio Altimeter indications are unreliable.

3. GLIDE SLOPE FLAG

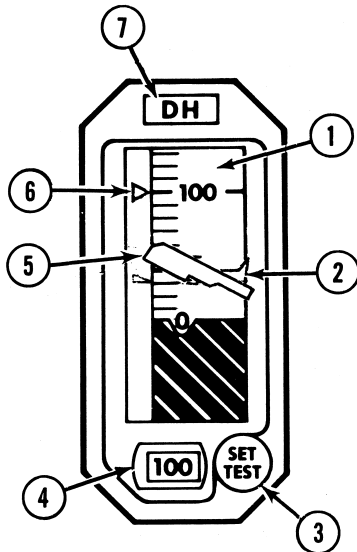
When tuned to an ILS frequency, if a flag appears, it indicates that the Glide Slope signals are unreliable. A flag will trigger the "INSTRUMENT WARN" light after glide slope capture.

4. DH LIGHT – INOPERATIVE

5. ATTITUDE WARNING FLAG

In view when the attitude indications are not reliable. When the flag appears it will trigger the "INSTRUMENT WARN" light.

RADIO ALTIMETER



1. MOVING TAPE

Shows actual height above the terrain to 2500'. Indicates black above 2500' and when the switch is off. Blue between 2500' and 1000'. Green between 1000' and 0' and black and white diagonal stripes below 0'.

2. ALTITUDE REFERENCE MARKER (Orange)

Reference for the Moving Tape to indicate radio altitude (AGL).

3. SET/TEST KNOB

Rotate to set DH bug and altitude in window. Push to test the Radio Altimeter.

4. COUNTER WINDOW

Indicates DH selected by Set Knob.

5. WARNING FLAG (Yellow)

Appears with a loss of power, an invalid signal, and during a test. If the flag appears below 1500' AGL, it will trigger the "INSTRUMENT WARN" light.

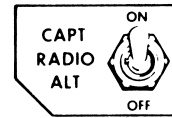
6. DECISION HEIGHT BUG (Orange)

Set by knob and travels with the Altitude Tape.

7. DECISION HEIGHT LIGHT (Amber)

Illuminates when descending thru 1000' and the selected DH. Pushing the light will extinguish the light except after descending below DH.

RADIO ALTIMETER SWITCH

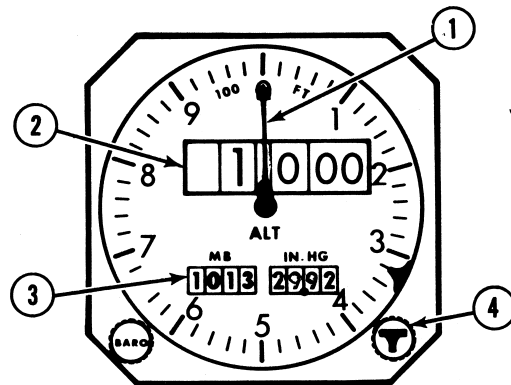


CAPTAIN'S AND FIRST OFFICER'S INSTRUMENT PANELS

The switch is used to remove power from the indicator when it is not in use.

CAPTAIN'S ALTIMETER

This is an electrically driven digital altimeter whose input signals are obtained from the Central Air Data Computer (CADC).



1. ALTITUDE POINTER

One full rotation of the pointer equals 1000 feet.

2. DIGITAL ALTITUDE READOUT WINDOW

Indicates altitude in 20 foot increments. When altitude is below 10,000 feet a green band appears in the left hand digit. Below SL the two left hand digits will indicate NEG. A red bar will appear across the window if information is unreliable.

3. BAROMETRIC SETTING CONTROL

Sets inches of Mercury and Millibars in their respective windows.

4. REFERENCE ALTITUDE SETTING KNOB AND ALTITUDE BUG

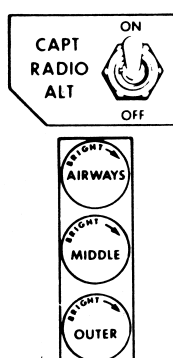
The knob is used for setting the bug to the desired altitude. This is a reference function only.

ALT. ALERT LIGHTS



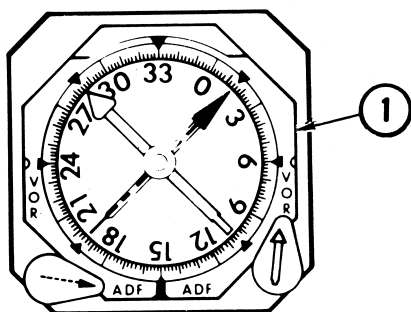
An "altitude alert" light is positioned above the altimeter. It will illuminate while the aircraft is 300-900 feet from the selected altitude. The light will flash when deviating from an altitude and is steady when going towards an altitude. A two second aural alert will sound when the light illuminates. Referenced to Number 2 CADC and Baro Set Unit.

MARKER BEACON LIGHTS



These are conventional "Marker Beacon lights." These may be rotated for adjusting brightness and are pushed for testing.

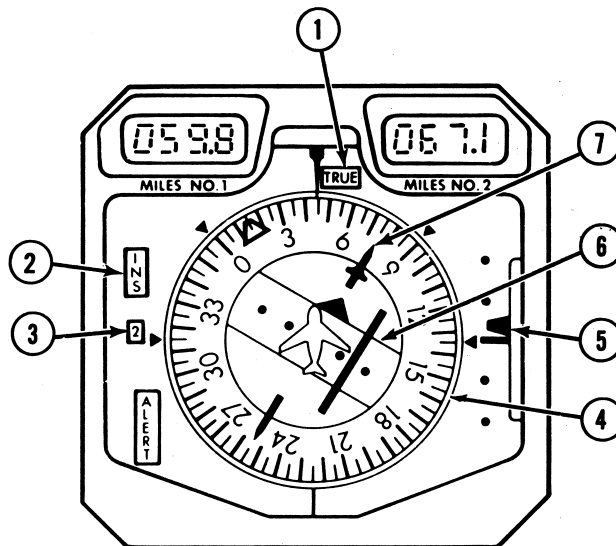
RMI INDICATOR



1. RADIO MAGNETIC INDICATION (RMI)

The RMI displays Magnetic Heading on the Rotating Compass Card in response from the Magnetic Heading Reference System. Two VOR/ADF selection knobs select input to No. 1 and No. 2 pointers respectively. An OFF flag will show if heading information is erroneous or missing.

HORIZONTAL SITUATION INDICATOR (HSI)



1. COMPASS CARD ANNUNCIATOR

Function of the Radio/INS switch position. It will indicate MAG with switch in Radio and "TRUE" with switch in INS.

2. RADIO/INS INDICATOR

Function of the Radio/INS Switch position and indicates which information is being displayed.

3. DATA SOURCE INDICATOR

Indicates which navigation source is being utilized. Captain will indicate No. 1 and F/O No. 2.

4. COMPASS CARD

Displays Heading under Lubber Line. Referenced to Magnetic North in Radio mode and True North in INS mode.

5. GLIDE SLOPE POINTER

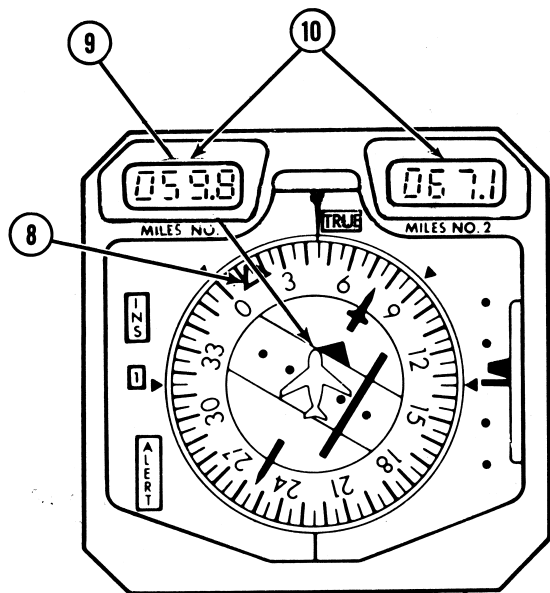
Same indication as the Glide Slope pointer on the ADI. It is out of view when an ILS frequency is not selected.

6. COURSE BAR

Rotates with the Course Pointer and displays the amount of displacement from the desired VOR radial, Localizer, or INS Track. Two dots equals 10° on VOR, 2½° on ILS and 7.5 NM on ONS.

7. COURSE POINTER

In Radio mode it moves in response to movement of the Course Selector. In INS mode, it will indicate Desired Track.



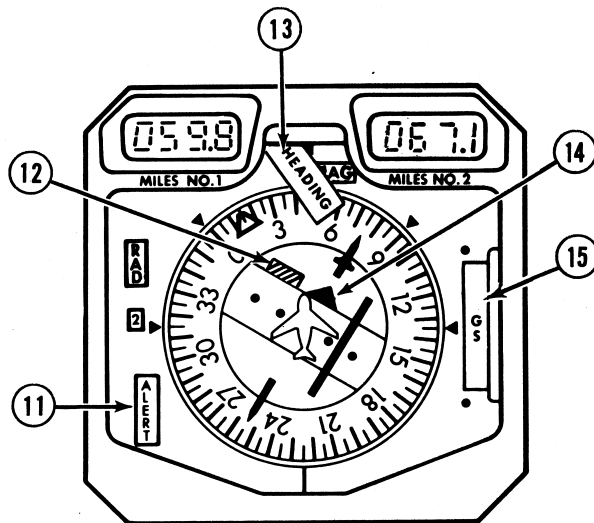
8. HEADING CURSOR

Indicates heading as selected by the Heading Selector and will rotate with the Compass Card when in Radio mode. The Cursor will indicate Ground Track Angle when ONS is displayed and will move as the Ground Track Angle changes.

9. FIXED AIRPLANE REFERENCE

10. DME INDICATOR

Digital readouts in tenths are displayed showing distance from the selected VOR station. DME switch must be in normal or override position for display. A blank window indicates a failure and dashed bar indicates that no computed data is being received.



11. INS ALERT LIGHT (Amber)

Repeats indications of the Alert Light on the ONS CDU when INS information is displayed.

12. NAVIGATION FLAG

Will be in view when VOR, Localizer or ONS Navigation signals are unreliable.

13. HEADING FLAG

Indicates the Heading information is unreliable.

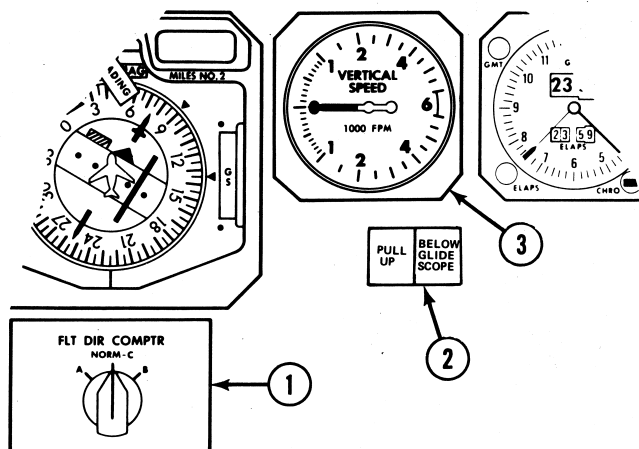
14. TO/FROM INDICATOR

Points to ONS "TO" waypoint in CDU From/To window if RAD/INS switch is in INS. If switch is in RAD, it will point to (or from the) VOR station.

15. GLIDE SLOPE FLAG

Indicates GS information missing or unreliable with an ILS frequency selected.

FLIGHT DIRECTOR COMPUTER SELECTION, GPWS AND VERTICAL SPEED INDICATION



1. FLIGHT DIRECTOR COMPUTER SELECTOR

The selection provides the means of selecting the Flight Director Computer that will provide pitch and roll commands to the Captain's ADI, and controls the Captain's F/D Progress Display lights.

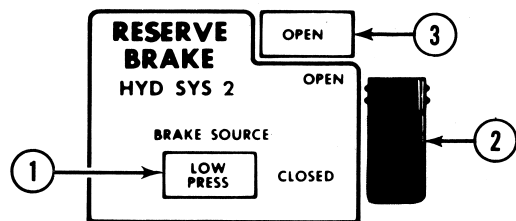
2. PULL UP/GLIDE SLOPE LIGHTS (GPWS)

Lights (RED – PULL UP, AMBER – BELOW GLIDE SLOPE) provide a visual warning of possible inadvertent contact with the ground. An aural warning accompanies the lights. Pressing the lightshield will test the system.

3. VERTICAL SPEED INDICATOR

The vertical speed indications are instantaneous.

RESERVE BRAKE SELECTOR MODULE



1. BRAKE LOW PRESSURE LIGHT (Amber)

Monitors the selected Normal Brake Source System pressure and will illuminate when system pressure is low. It will monitor the Reserve System pressure when the Reserve Brake Switch is in the "OPEN" position.

2. RESERVE BRAKE SWITCH

The switch is guarded CLOSED. When positioned to OPEN the No. 2 Hydraulic System will pressurize the Reserve Brake System.

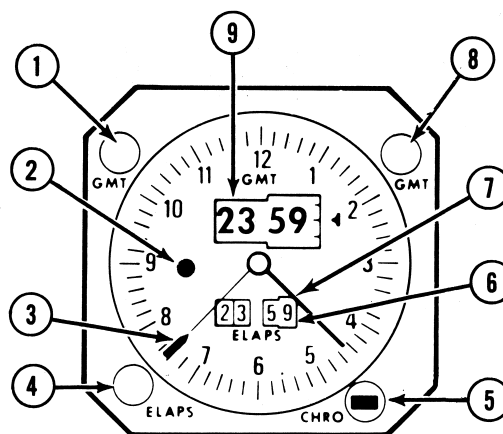
3. RESERVE BRAKE VALVE OPEN LIGHT (Green)

Illuminates when the Reserve Brake Valve is OPEN.

NOTE:

Parking brakes will not hold on system No. 2 if it is depressurized.

CLOCK



1. GMT HOUR SET KNOB

2. POWER INDICATION

BLACK – Indicates system is powered and time has been updated.

RED – Power has been interrupted and system has not been updated.

3. MINUTE MARKER

4. ELAPS BUTTON

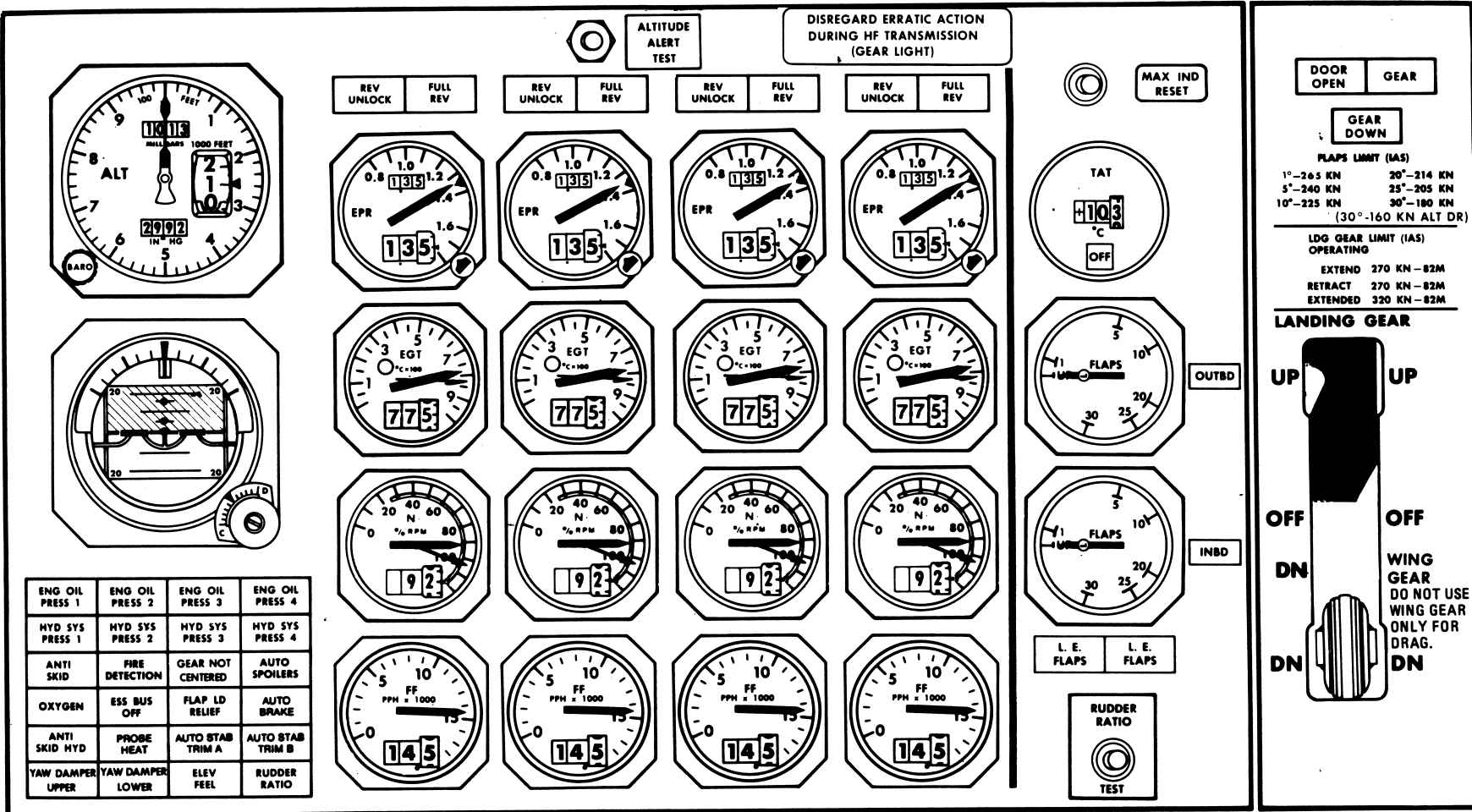
5. CHRO BUTTON

6. ELAPS INDICATOR

7. SWEEP SECOND HAND

8. GMT MINUTE SET KNOB

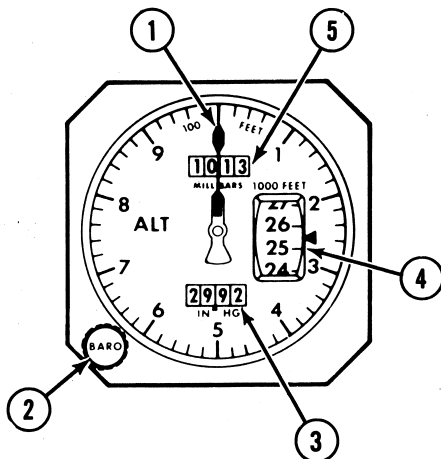
9. GMT INDICATOR



CENTER INSTRUMENT PANEL

THIRD ALTIMETER

This is a barometric Altimeter and receives its input from the Captain's Static System.



1. ALTITUDE POINTER

One full rotation equals 1000'.

2. BAROMETRIC SETTING CONTROL

Rotation adjusts Millibar and Inches of Mercury indicators.

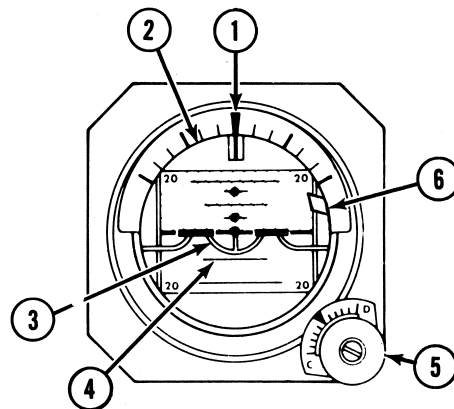
3. BAROMETRIC SETTING INDICATOR (INCHES OF MERCURY)

4. 1000 FOOT INDICATOR

Displays altitude in thousands of feet.

5. BAROMETRIC SETTING INDICATOR (MILLIBARS)

STANDBY HORIZON



1. BANK ANGLE INDICATOR

2. BANK ANGLE SCALE

3. FIXED AIRPLANE SYMBOL

Displays airplane Pitch and Roll attitude against a moveable sky-ground tape.

4. PITCH SCALE

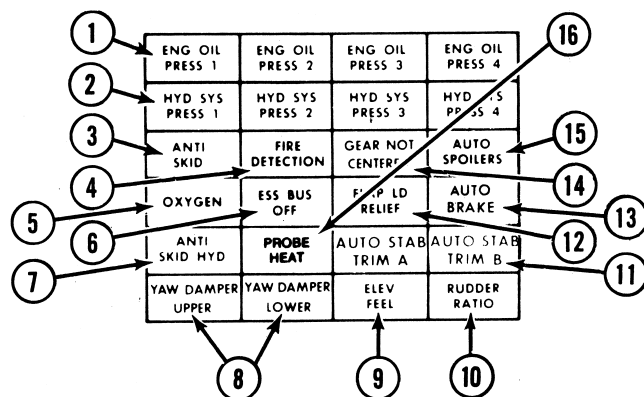
5. CAGING CONTROL/PITCH TRIM CONTROL/SCALE

Pull out for caging. When control is in, rotation adjusts fixed airplane reference. Scale is calibrated in one degree increments for Dive and Climb.

6. WARNING FLAG

In view when power is not available or for a gyro fault.

PILOT'S ANNUNCIATION PANEL (ALL AMBER LIGHTS)



1. ENGINE OIL PRESSURE LIGHT

Illuminates when pressure is low.

2. HYDRAULIC SYSTEM PRESSURE LIGHT

Illuminates if both ADP and EDP pressures are low for the related systems.

3. ANTI-SKID LIGHT

Indicates electrical failure in the Normal or Reserve Anti-Skid System. Also illuminates with the Anti-Skid Switch OFF. It is deactivated with the landing gear up.

4. FIRE DETECTION LIGHT

Repeats the Nacelle Fire Detection Fault Light indications.

5. OXYGEN LIGHT

Indicates the system has been activated.

6. ESSENTIAL BUS OFF LIGHT

Repeats the light on the F/E's electrical panel indicating the Essential AC Bus is without power.

7. ANTI-SKID HYDRAULIC LIGHT

Illuminated when the Parking Brake Valve is not in full OPEN position.

8. YAW DAMPER LIGHTS

Indicates that the corresponding Turn Coordination feature is unreliable.

9. ELEVATOR FEEL LIGHT

Indicates partial loss of the Elevator Feel Computer System.

10. RUDDER RATIO LIGHT

Monitors the two Rudder Ratio Changers. Illumination of the light indicates a significant difference between Ratio Changer inputs to the rudders.

11. STAB TRIM FAILURE LIGHTS

Indicates the Automatic Stabilizer Trim System is not trimming out elevator loads from the autopilot resulting in a sustained out-of-trim condition existing between the stabilizer and elevators.

12. FLAP LOAD RELIEF LIGHT

Indicates airspeed is approaching the Flap Placard Speed when the flaps are set at 30. The flaps will automatically retract to 25 and return to 30 when a lower airspeed is indicated.

13. AUTO BRAKE LIGHT

Flashes to indicate the system is disarmed. It will extinguish when the Auto Brake Selector Switch is positioned to "OFF."

14. GEAR NOT CENTERED LIGHT

Indicates that the Body Gear is not centered and is unlocked.

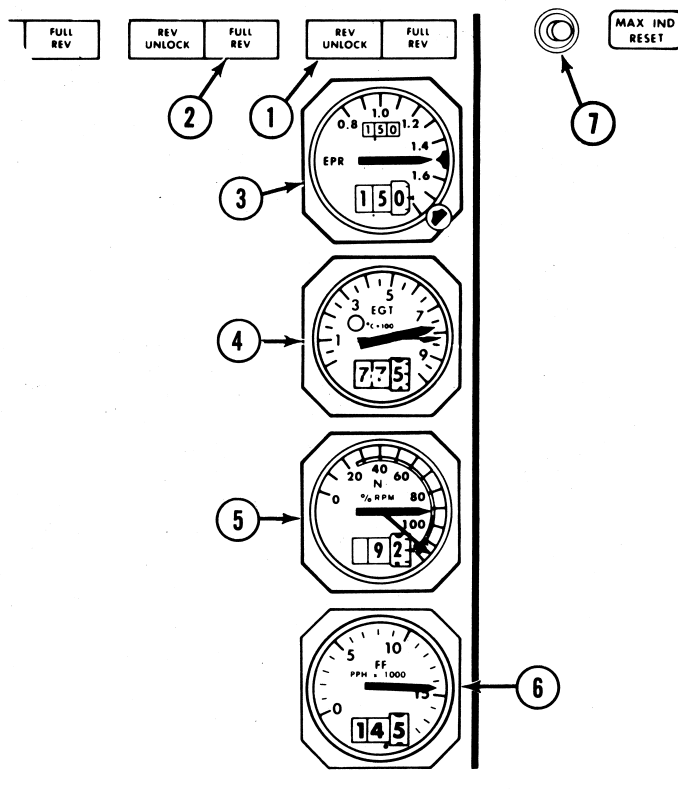
15. AUTO SPOILER LIGHT

Indicates the Automatic Ground Spoiler System is inoperative.

16. PROBE HEAT LIGHT

Comes on if any pitot or TAT probe heater is inoperative.

ENGINE INDICATING INSTRUMENTS



All indications are electrically powered. Each indicator has a drum type digital readout in addition to a pointer. With electrical power failure or an instrument failure, a yellow warning flag will drop in front of the digital readout in the window.

1. REVERSER UNLOCKED LIGHT (Amber)

Illuminates when the Fan Reverser is in transit.

2. FULL REVERSE LIGHT (Green)

Illuminates when the Fan Reverser is in the full reverse position.

3. ENGINE PRESSURE RATIO INDICATION (EPR)

Used as the primary thrust setting indication. A knob on the lower right of the instrument sets the desired EPR setting in the upper window and positions the "BUG" to a corresponding position on the scale.

4. EXHAUST GAS TEMPERATURE INDICATION (EGT)

Indicates temperature of exhaust gas between turbines. An amber light on the indication face illuminates to warn of impending over-temperature. A Maximum Indicating Pointer will register an over-temperature and remains at the highest readings until it is reset.

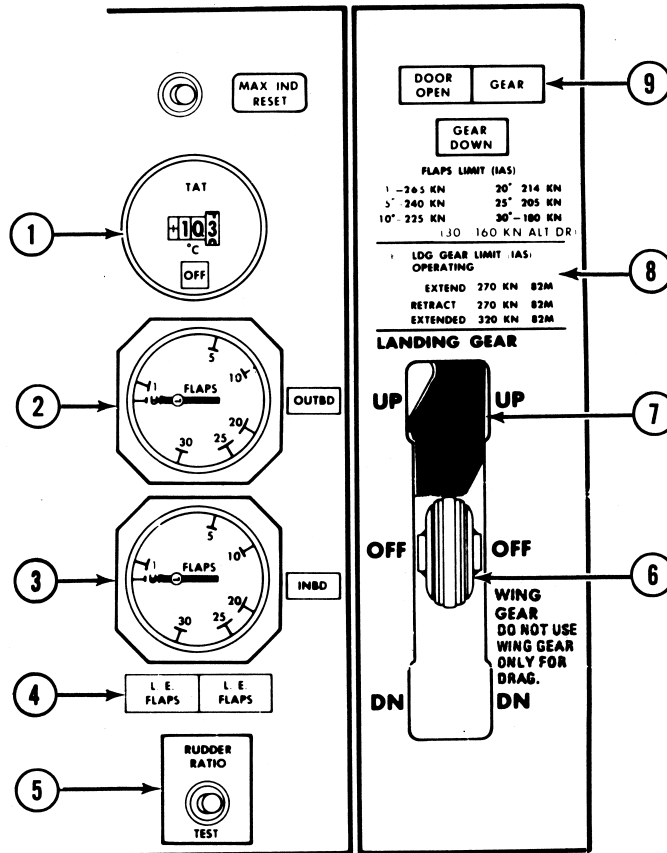
5. N1 RPM INDICATOR

Indicates percent of RPM of the low pressure compressor. It is used as a secondary thrust setting instrument. A Maximum Indication Pointer registers an overspeed and will remain at the highest reading until it is reset.

6. FUEL FLOW INDICATOR

7. MAXIMUM INDICATION RESET SWITCH

Used to reset the Maximum Indication Pointers on the N1 and N2 tachometers and EGT indicators.



1. TOTAL AIR TEMPERATURE INDICATOR (TAT)

Indicates TAT from the RAM Air Temperature Probe. A yellow OFF flag appears when information is unreliable.

2. OUTBOARD TRAILING EDGE FLAP INDICATION (LEFT AND RIGHT POINTERS)

3. INBOARD TRAILING EDGE FLAP INDICATION (LEFT AND RIGHT POINTERS)

4. LEADING EDGE FLAP POSITION LIGHTS

The left (amber) light indicates the leading edge flaps are in transit or not in agreement with the trailing edge flap position. The right (green) light indicates the leading edge flaps are extended and in accord with the trailing edge flap position.

5. RUDDER RATIO TEST SWITCH

When pushed, the Rudder Ratio Light will illuminate, testing operation of the Rudder Ratio Changer Comparator.

6. LANDING GEAR HANDLE

Three position handle – DOWN, UP and OFF. The UP and DOWN positions control pressure to extend and retract the landing gear. The OFF position depressurizes the gear and door actuators.

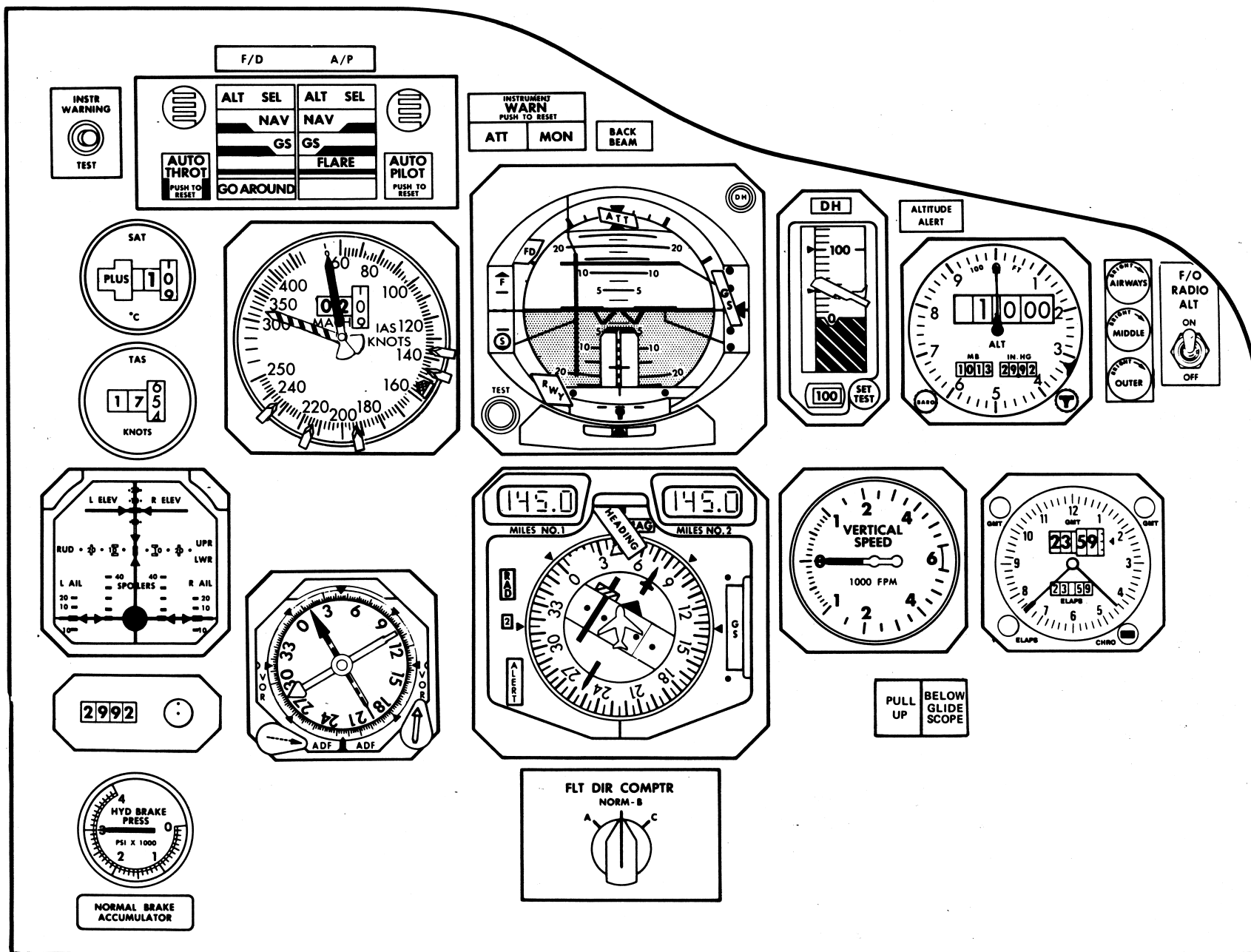
7. LANDING GEAR HANDLE LATCH

Prevents moving the landing gear handle to the UP position when the main landing gear trucks are not tilted and the body gear is not centered. The latch may be manually moved out of the way after determination is made that the landing gear can be safely retracted.

8. FLAP AND LANDING GEAR PLACARD LIMITS

9. GEAR (Red), GEAR DOOR (Red), AND GEAR DOWN (Green) LIGHTS

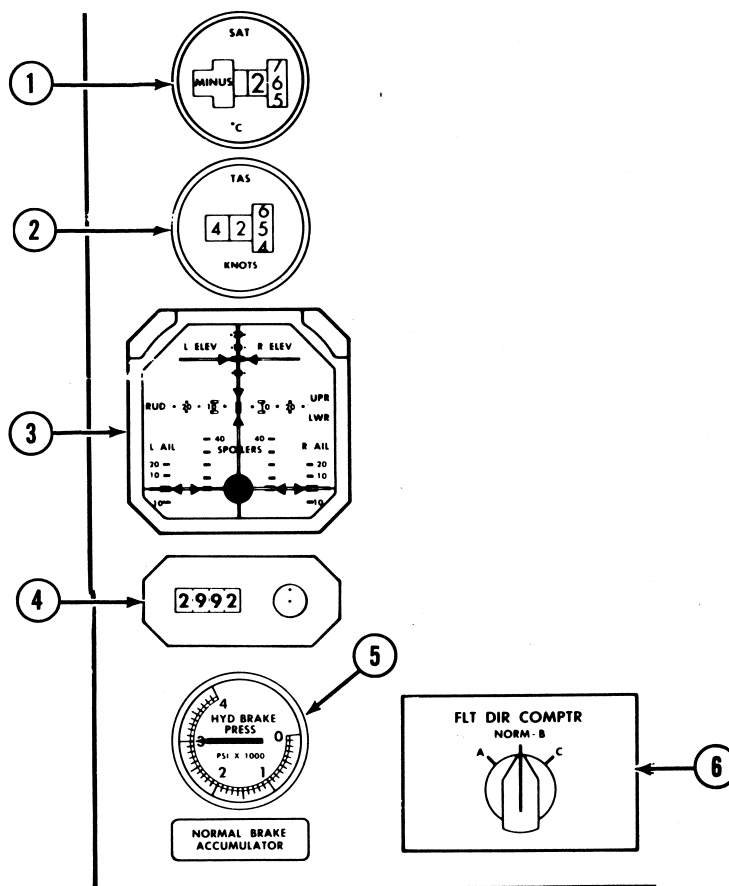
Summary lights of Gear and Gear Door positions. (See F/E Gear Annunciator Panel.)



FIRST OFFICER'S INSTRUMENT PANEL

F/O INSTRUMENT PANEL

Many of the instruments, lights, and switches are identical to those on the Captain's Panel. Only those items that are different are described.



1. STATIC AIR TEMPERATURE INDICATOR (SAT)

Indicates Static Air Temperature on a drum type digital indicator. Temperatures above 0°C are read on the left and below 0°C on the right. A MINUS or a PLUS is in view opposite the temperature indication. A yellow flag will drop over the readout if the information is unreliable.

2. TRUE AIRSPEED INDICATOR (TAS)

Indicates True Airspeed as derived from the Central Air Data Computer No. 1. A yellow flag covers the indication when the information is unreliable.

3. FLIGHT CONTROL COMPOSITE POSITION INDICATION

Monitors the position of the outboard elevators, rudders, outboard ailerons, and No. 4 and No. 12

spoilers in degrees of deflection. Delta indicies indicate relative position surface is moved from neutral center line.

4. BAROMETRIC SETTING UNIT

The Baro Set Unit is used to set the Barometric Reference for the altitude alert and AP/FD altitude select systems.

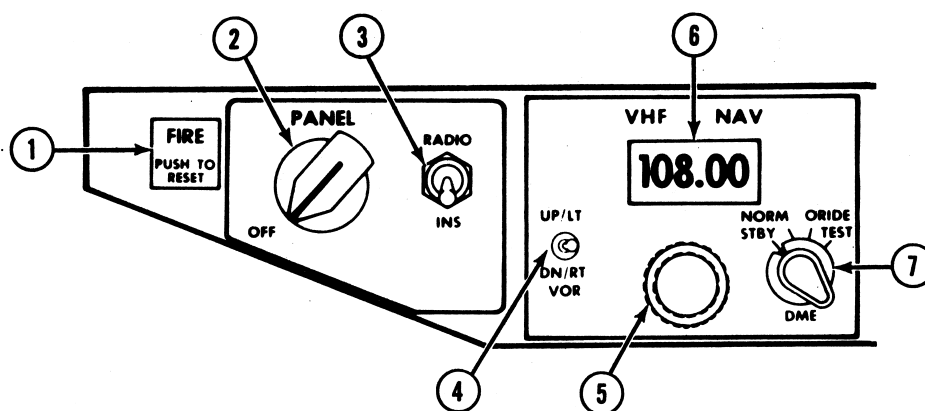
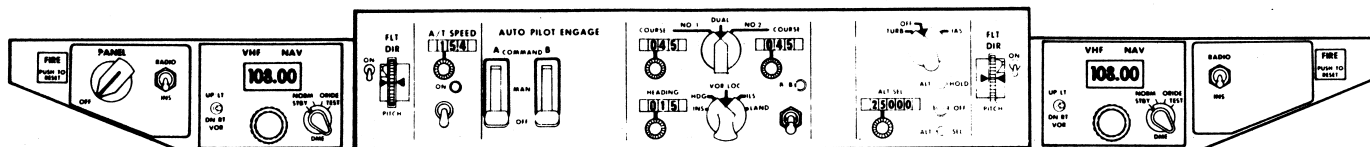
5. HYDRAULIC BRAKE PRESSURE INDICATION

Indicates normal brake system pressure. With no system pressure it indicates accumulator precharge pressure.

6. FLIGHT DIRECTOR COMPUTER SELECTION SWITCH

Used to select the F/D Computer to supply Pitch and Roll commands to the F/O's ADI and controls the F/O's F/D Approach Progress Display lights.

NAVIGATION AND AUTO FLIGHT PANEL



1. MASTER FIRE WARNING LIGHTS (Red)

Illuminates for a fire condition and Fire Test. Pressing the light silences the warning bell, extinguishes the master fire warning lights and resets the system.

2. LIGHT SWITCH

Controls the intensity of edge lighting on the NAV and A/F panel lightshield, and mode select lights.

3. RADIO/INS SWITCHES

Selects either VHF or ONS navigation raw data for display on the respective HSI. (See HSI.)

4. TEST SWITCHES

Used to perform VOR and ILS tests.

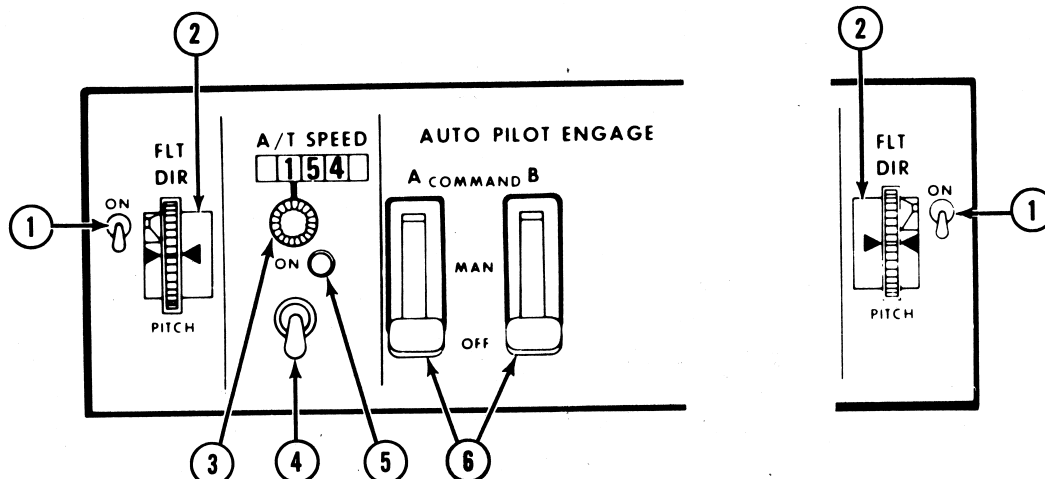
5. VHF NAV FREQUENCY SELECTORS

6. VHF NAV FREQUENCY DISPLAY

7. DME SWITCHES

STBY for warm up, NORM for normal operation, ORIDE for extended range. The DME also has test capability. In TEST the DME indicator will display dashed lines for one second and then 000.0 ± 1 .

AUTOPILOT/FLIGHT DIRECTOR MODE SELECTOR PANEL



1. FLIGHT DIRECTOR SWITCHES

Activates the command bars on the respective ADI's and respective lights on the FD approach progress displays.

2. FLIGHT DIRECTOR TRIM CONTROL WHEELS

Used to manually position the pitch command bars on the respective ADI's when not in a pitch command mode.

3. AUTOTHROTTLE SPEED SELECTION

Sets the desired autothrottle airspeed in the indicator and positions the command airspeed bugs on the Pilot's airspeed indicators, to a corresponding airspeed. It also references this speed to the Fast/Slow indicator on the ADI's.

4. AUTOTHROTTLE ENGAGE SWITCH

When the switch is positioned to ON the adjacent mode select light will illuminate and the throttles will move automatically to maintain the selected airspeed. To disconnect, actuate the AP/ Autothrottle Disengage switch on the Pilot's Control Wheel, any of the 4 palm switches on the throttles or turn off the Autothrottle switch.

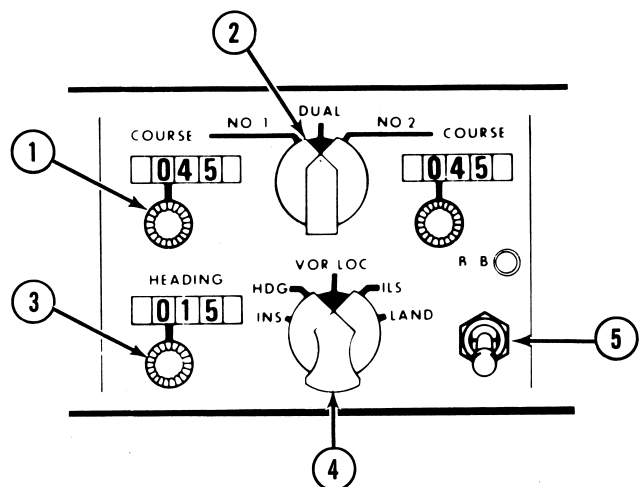
5. AUTOTHROTTLE LIGHT (Green)

Illuminates when the Autothrottle is engaged.

6. AUTOPILOT ENGAGE SWITCHES

Paddle switches for the selection of A/P A or B for Manual or Command operation. If in the Land mode both paddle switches may be engaged in Command. To disconnect, actuate the AP/ Autothrottle Disengage switch on the Pilot's Control Wheel, the No. 2 or No. 3 palm operated switches (if engaged in land or ILS with glideslope captured) or position the engage switch to OFF.

AUTO FLIGHT MODE SELECTOR PANEL



1. COURSE SELECTORS

Rotation sets the desired VHF NAV Course in the digital display, positions the course pointer on the respective HSI and feeds the selected Course information into the AP/FD computers.

2. COURSE TRANSFER SWITCH

Selects which VHF NAV Receiver and Course selection information to be fed into all AP/FD computers. The transfer switch has no effect on the Course Pointers or Course Bars in the HSI's. The Course Transfer Switch will return to Dual if ILS or Land mode is selected.

3. HEADING SELECTOR

Sets the desired Magnetic Heading Cursors on the HSI's and supplies the selected heading to the AP/FD computers.

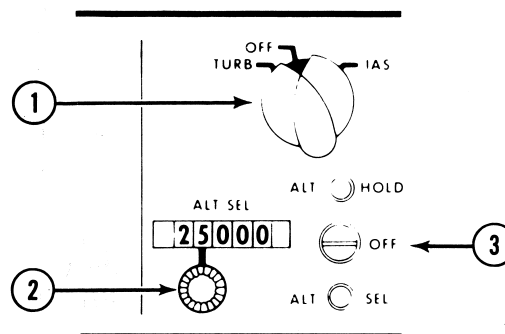
4. NAVIGATION MODE SWITCH

Selects the source of navigation information to be used by the AP/FD computers.

5. BACK BEAM SWITCH

Provides directional roll commands only on the ADI's when flying a back course ILS. The adjacent mode select light will illuminate when the switch is engaged.

AUTO FLIGHT PITCH MODE SELECTOR PANEL



1. SPEED MODE SWITCH

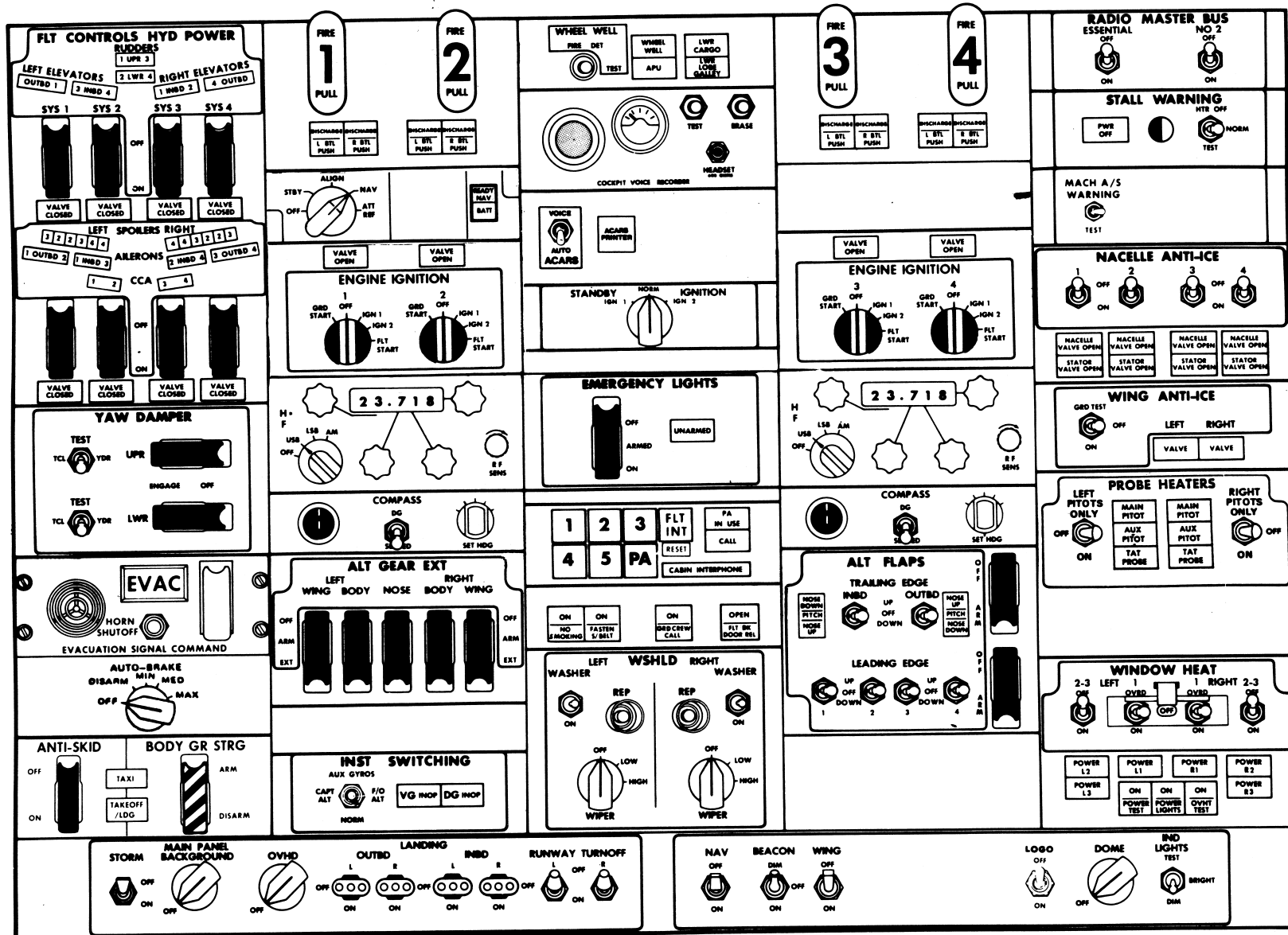
Selection of TURB provides reduced A/P pitch and roll rates, disables automatic stabilizer trim and ALT HOLD/SEL. If an autopilot is in command it will drop to manual. IAS provides pitch commands to the AP/FD to maintain the airspeed at the time of selection. Either selection will trip off the altitude mode selection except ALT SEL if not in a capture mode.

2. ALTITUDE SELECTION

Used to set the altitude desired for altitude capture for the AP/FD system and altitude alert. (See Baro Set Unit.)

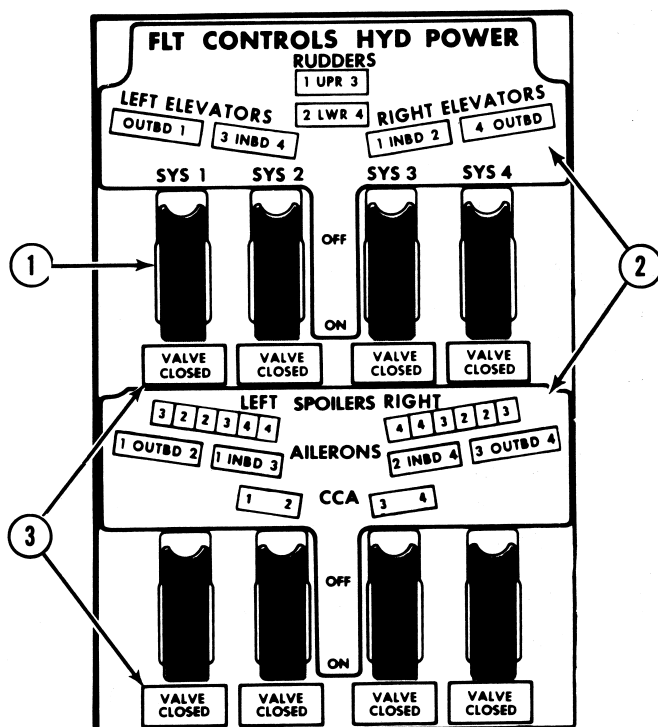
3. ALTITUDE MODE SELECT SWITCH

Altitude Hold selection provides commands from the AP/FD to maintain the altitude at the time of selection. Altitude Select provides commands from the AP/FD to capture and hold the altitude selected on the Altitude Selector. Selecting ALT HOLD, or ALT SEL if in the capture mode, will trip the Speed Mode Switch to OFF. The Mode Select Lights indicate which mode has been selected. The F/D must be ON and/or the A/P engaged in MANUAL or COMMAND for engagement of ALT HOLD. The F/D switch must be on and/or the A/P in COMMAND for engagement of ALT SEL.



PILOT'S OVERHEAD PANEL

HYDRAULIC POWER MODULE



1. HYDRAULIC POWER SWITCHES

Control system pressure to the rudder, elevator, spoiler, aileron and CCA actuators. The Hydraulic Power Switches are for the use of maintenance only.

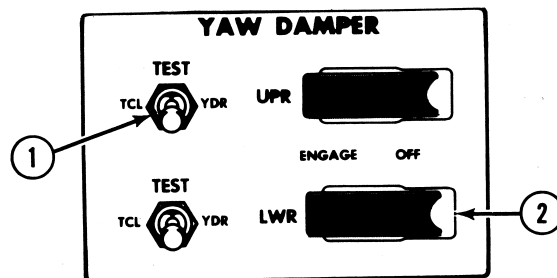
2. LATERAL CONTROL LIGHT PLATE

Placards indicate the hydraulic power source to control surfaces and CCA's.

3. VALVE CLOSED LIGHTS

Illuminate when their corresponding shutoff valves are not fully open.

YAW DAMPERS



This system automatically dampens yaw tendency, improves directional stability and provides turn coordination with wing flaps extended.

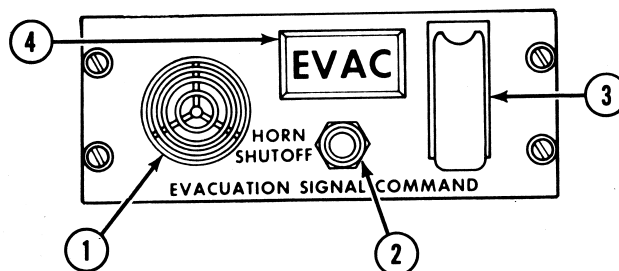
1. TEST SWITCHES

Three position switches spring loaded to center. TCL position tests the Turn Coordinator. YDR position tests the Yaw Damper. (See ADI Rate of Turn Indicator.)

2. ENGAGE SWITCHES

Guarded engaged. If OFF, the respective Yaw Damper will be inoperative. (See Yaw Damper lights on Pilot's Annunciator Panel.)

EVACUATION SIGNAL PANEL



In addition to the Overhead Panel, there is one panel at each Main Entry Door at the Flight Attendant Station (11 total).

1. HORN

Sounds when any command switch is activated.

2. HORN SHUT-OFF

Silences horn at this panel only.

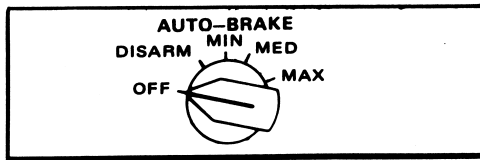
3. COMMAND SWITCH

Activates the alarm system.

4. EVACUATION LIGHT

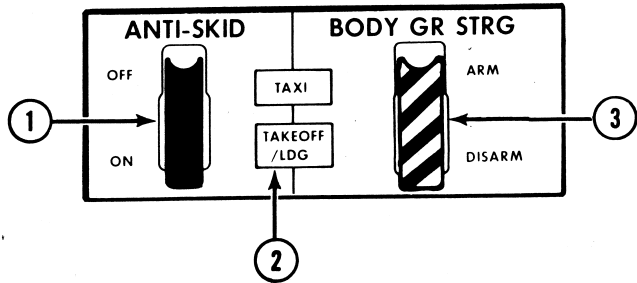
Flashes when any command switch is activated.

AUTO BRAKE SWITCH



(Push in and rotate to select.)

The selections MIN or MED are aircraft deceleration rates. MAX is for emergency braking only. Switch will trip to disarm if there is an Auto Brake or Anti-Skid fault. (See Auto Brake on Pilot's Annunciator Panel.)



1. ANTI-SKID SWITCH

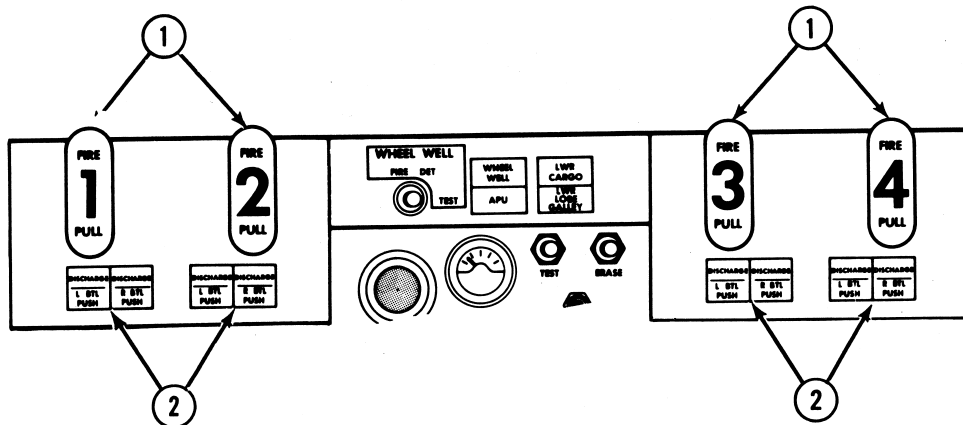
Deactivation of the Anti-Skid system is accomplished by placing this switch to OFF. (See F/E Anti-Skid Lights and Anti-Skid Light on Pilot's Annunciator Panel.)

2. TAXI-TAKE-OFF/LNDG PLACARD

Indicates normal position of the switches for taxi and take-off/landing.

3. BODY GEAR STEERING SWITCH

Activation of body gear steering is made available by placing this switch to ARM. (See FE Body Gear Steering Lights and Gear Not Centered Light on Pilot's Annunciator Panel.)



1. ENGINE FIRE HANDLES (Red)

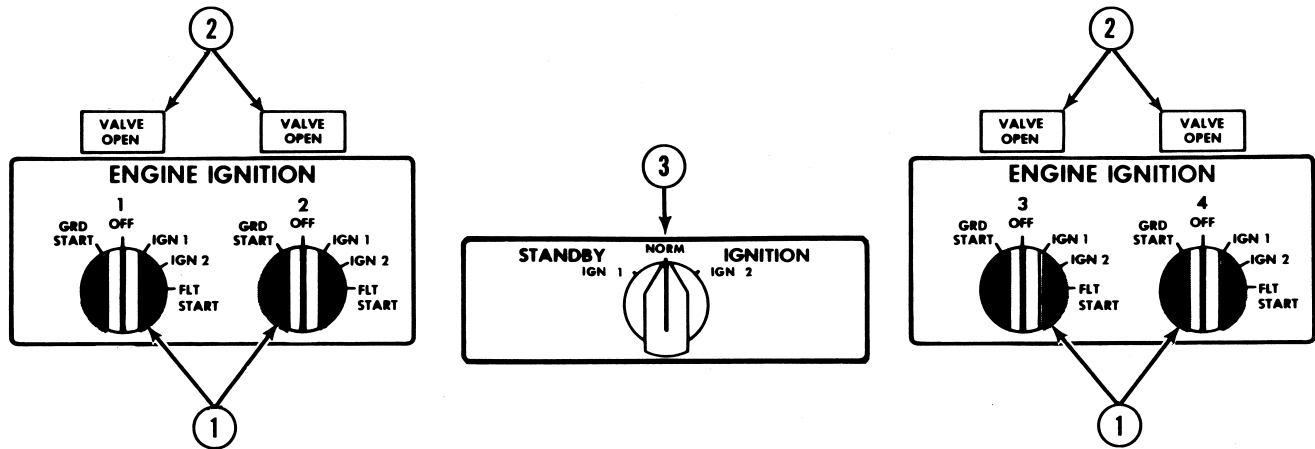
Illuminates for a nacelle fire or during test. Pulling the handle arms the fire extinguisher discharge switches, closes the fuel valve, depressurizes the engine driven hydraulic pump and shuts off the fluid supply, trips the generator field and closes the bleed air valve. A yellow flag rotates into view to lock the switch in the pulled position.

2. ENGINE FIRE EXTINGUISHER DISCHARGE SWITCHES

When the fire handle is pulled, pushing the light/switch discharges the fire extinguisher and illuminates the light in the switch to indicate the bottle has discharged.

There are two bottles per engine.

ENGINE IGNITION SWITCHES



1. ENGINE IGNITION SWITCHES

Rotary switch which provides multiple selections of Dual or Single ignition. Gnd Start is used for engine starting using APU or external bleed air and during crossbleed starts. Flt Start is used to start a windmilling engine and during take-off, landing and adverse weather conditions.

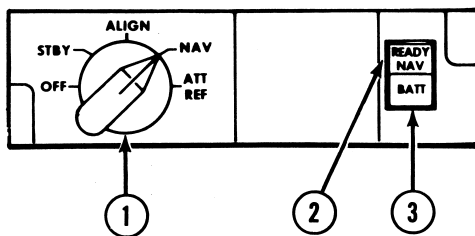
2. STARTER VALVE OPEN LIGHT (Green)

Illuminates to indicate air is available to the starter turbine.

3. STANDBY IGNITION SWITCH

Rotary switch provides ignition for emergency in-flight starting or a battery start when AC electrical power is not available.

INS MODE SELECTOR UNIT



1. SELECTOR SWITCH

Used to select the operating modes. (See INS Control Display Unit [CDU].)

2. BATT LIGHT (Red)

Light indicates low battery power, which will cause INS shutdown.

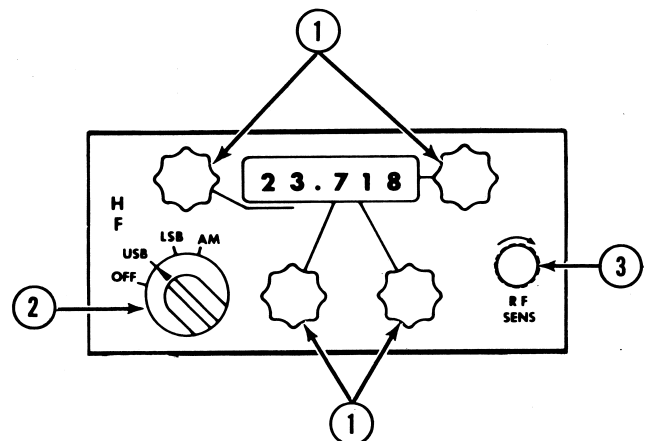
3. READY NAV LIGHT (Green)

Light indicates INS is ready for navigating.

NOTE:

BATT and NAV lights are push-to-test.

HF RADIOS

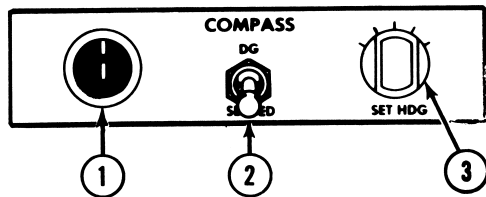


1. FREQUENCY SELECTOR KNOBS

2. MODE SELECTOR

3. RF SENSITIVITY KNOB

COMPASS CONTROL SWITCHES



1. SYNCHRONIZATION ANNUNCIATOR

Provides indications of the compass coupler synchronization. Centered when operating in the DG mode.

2. SYNCHRONIZATION SWITCH

Selects slaved compass operation or free directional gyro operation.

3. SET HEADING KNOB

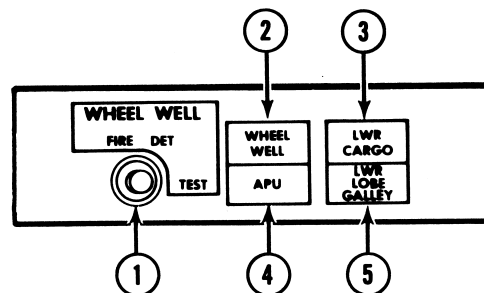
Used to manually synchronize the compass coupler and rotate the compass card.

1. Provides selection of auxiliary gyros to replace the Captain's INS stable platform or F/O's AHSU No.2. Provides gyro reference to the compass system and attitude instrument.

2. VERTICAL AND DIRECTIONAL GYRO INOP LIGHTS (Amber)

Indicates failure of auxiliary gyros.

PILOT'S FIRE WARNING INDICATORS



1. WHEEL WELL FIRE DETECTION TEST SWITCH

Push to check the wheel well fire detection circuits. Illuminates the master fire and wheel well warning lights, and sounds the fire warning bell.

2. WHEEL WELL FIRE WARNING LIGHT (Red)

Illuminates for a wheel well fire condition or during test without a detection failure. It will remain illuminated as long as a fire condition exists.

3. LOWER CARGO FIRE WARNING LIGHT (Red)

Illuminates for either a FWD or AFT lower cargo fire condition or during test. It will remain illuminated as long as a smoke condition exists.

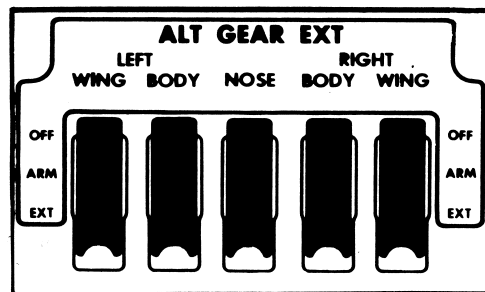
4. APU FIRE WARNING LIGHT (Red)

Illuminates for an APU fire condition or during test. Light remains illuminated as long as a fire condition exists.

5. LOWER LOBE GALLEY FIRE WARNING LIGHT (Red)

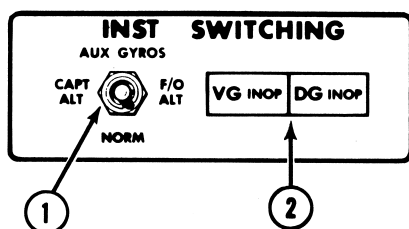
Illuminates for either a FWD or AFT Galley fire condition or during test. It will remain illuminated as long as a smoke condition exists.

ALTERNATE LANDING GEAR EXTENSION SWITCHES

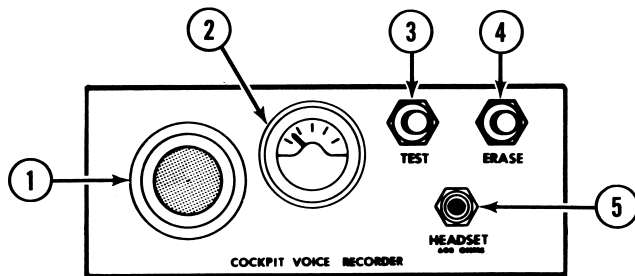


Three position switches, guarded to OFF, electrically unlocks the gear doors and landing gear uplocks to permit the gear to free fall to the down position.

INSTRUMENT SWITCHING



VOICE RECORDER



The voice recorder runs through a complete cycle every 30 minutes. A cycle consists of erasing the old recording while recording the new.

1. MICROPHONE

2. TEST INDICATOR

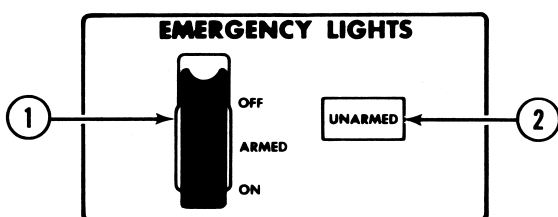
3. TEST SWITCH

4. ERASE SWITCH

Aircraft must be on the ground with parking brake set and AC power available.

5. HEADSET JACK

EMERGENCY LIGHT CONTROL SWITCH



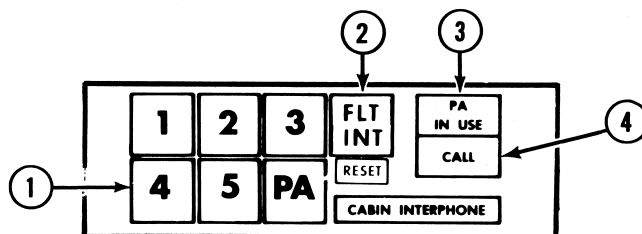
1. EMERGENCY LIGHTS SWITCH

The 3 position switch is guarded to the armed position with the switch in the armed position. The F/A at Door 1L may activate the lights or the light will automatically illuminate with loss of essential DC power. ON position controls emergency lights for aisles, cross-aisles, exits, and exterior escape slides.

2. EMERGENCY LIGHTS UNARMED LIGHT (Amber)

Illuminated with the switch ON or OFF with Essential power available, or if 1L F/A switch is activated.

CABIN INTERPHONE, COMMUNICATION CONTROL PANEL



1. DIALING PUSHBUTTONS

Selects F/A station(s) or PA by successively pushing two pushbuttons.

2. FLT - INT SWITCH

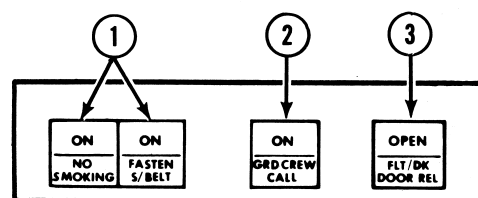
Connects the flight deck interphone system to the cabin interphone system when pushed in.

3. PA IN USE LIGHT (Green)

Illuminates when the handset is removed from the holder if an attendant is making a PA.

4. CALL LIGHT (Blue)

Illuminates steady for a routine call from the F/A and flashes for a priority call.



1. PASSENGER SIGNS CONTROL

Switches are press to operate with a white light illuminated indicating switches are ON.

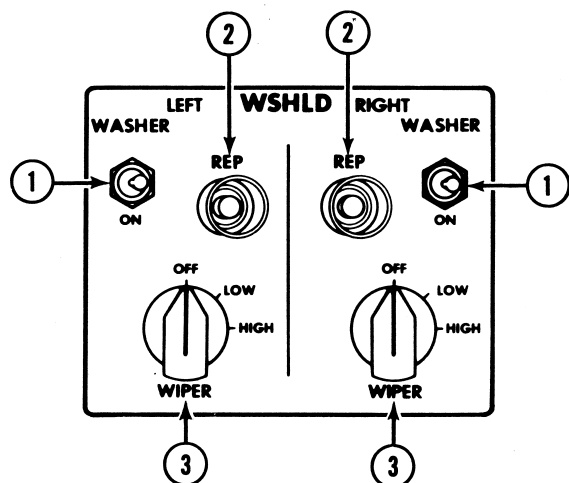
2. GROUND CREW CALL SWITCH

Used to alert the ground crew by pressing to sound a horn in the nose wheel well. The white light will illuminate and a chime will sound if a switch in the nose gear is actuated to alert the crew.

3. FLIGHT DECK DOOR RELEASE SWITCH

Pressing unlocks the cockpit door. The white light remains illuminated while the cockpit door is unlocked.

WINDSHIELD WASHER, REPELLENT AND WIPER



1. WINDSHIELD WASHER SWITCHES

Momentary switches apply washers fluid as long as switch is held.

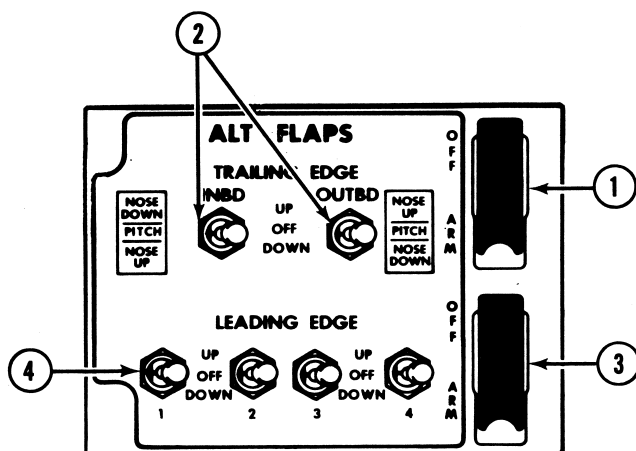
2. RAIN REPELLENT SWITCHES

Pressing momentarily applies one application.

3. WINDSHIELD WIPER SWITCH

Allows high or low speed wiper blade operation. The OFF position parks the blades.

ALTERNATE TRAILING EDGE AND LEADING EDGE FLAP DIRECTIONAL SWITCHES



1. Arming switch for alternate trailing edge flap operation. In arm, the hydraulic flap motors are bypassed and the directional switches are armed.
2. Three position directional switches operate the trailing edge flaps electrically.
3. Arming switch for alternate leading edge flap operation. In arm, only the directional switches are armed.
4. Three position directional switches to cutoff the air to the pneumatic drive motors and operate the leading edge flaps electrically.

RADIO MASTER BUS CONTROLS



1. ESSENTIAL RADIO BUS SWITCH

Connects the AC and DC Essential Radio Busses to the main AC and DC essential busses.

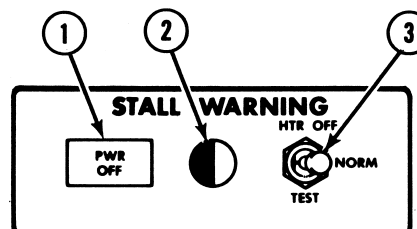
2. NO. 2 RADIO BUS SWITCH

Connects the AC and DC Radio Busses No. 2 to the main AC and DC Busses No. 2.

NOTE:

No. 1 VHF COMM and NAV are powered by the standby busses and are on anytime the standby busses are powered.

STALL WARNING



1. POWER OFF LIGHT (Amber)

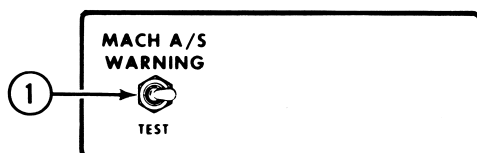
Illuminated for a sensor heater failure and when using other than airplane generators except during test.

2. TEST INDICATOR

A black and white disc which will spin during testing to indicate reliable inputs from the stall warning sensor and flap position indicator.

3. STALL WARNING SWITCH

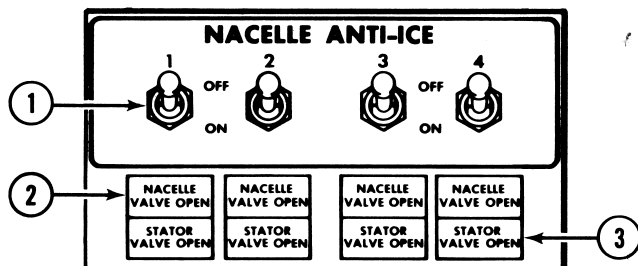
Momentarily holding in the TEST position causes the test indicator to spin, the stick shaker to operate and the amber power off light to extinguish. This checks the computer and sensor heater operation. Maintenance may use the off position to turn off the sensor heater. The operational position is NORMAL.



1. MACH AIRSPEED WARNING SWITCH

A spring loaded test switch for electrically testing the warning system. An oral warning will sound (clacker) when the system is tested.

NACELLE ANTI-ICE



1. NACELLE ANTI-ICE SWITCHES

The ON position energizes the valve solenoids permitting the nacelle anti-ice and stator valves to open pneumatically with engine bleed air.

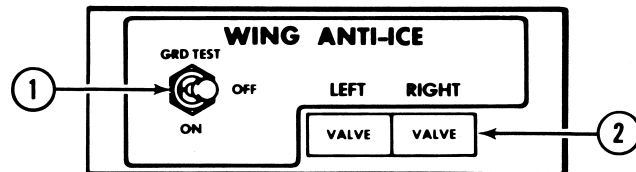
2. NACELLE ANTI-ICE VALVE OPEN LIGHTS (Green)

Illuminates to indicate the valve is open and bleed air is being directed to the inlet cowl and EPR probe. (See TAI Valve Lights on F/E Door Annunciator Panel.)

3. STATOR VALVE OPEN LIGHTS (Green)

Illuminates to indicate the valve is open and bleed air is being directed to the first stage stator vanes.

WING ANTI-ICE



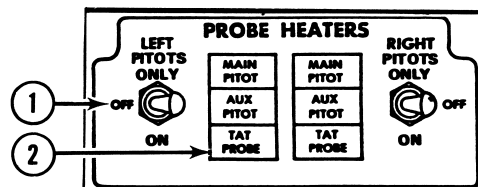
1. WING ANTI-ICE SWITCH

The ON position is functional only in flight to open the wing anti-ice valves to direct bleed air from the pneumatic manifold to the wing leading edges. The test position overrides the ground safety relay lockout and opens the valves for ground test. If an overheat occurs while testing, the valves will automatically close, bypassing the test position.

2. WING ANTI-ICE VALVE LIGHTS (Blue)

Illuminated only when the valves are in transit or are not in agreement with the switch position.

PROBE HEAT



PILOT'S OVERHEAD PANEL

ENG OIL PRESS 1	ENG OIL PRESS 2	ENG OIL PRESS 3	ENG OIL PRESS 4
HYD SYS PRESS 1	HYD SYS PRESS 2	HYD SYS PRESS 3	HYD SYS PRESS 4
ANTI SKID	FIRE DETECTION	GEAR NOT CENTERED	AUTO SPOILERS
OXYGEN	ESS BUS OFF	FLAP LD RELIEF	AUTO BRAKE
ANTI SKID HYD	PROBE HEAT	AUTO STAB TRIM A	AUTO STAB TRIM B
YAW DAMPER UPPER	YAW DAMPER LOWER	ELEV FEEL	RUDDER RATIO

CENTER PANEL

1. LEFT AND RIGHT PROBE HEAT SWITCHES

The "ON" position applies heat to the respective main and auxiliary pitot-static probes and temperature probes. PITOT ONLY position applies heat to the main and aux pitot-static probes only.

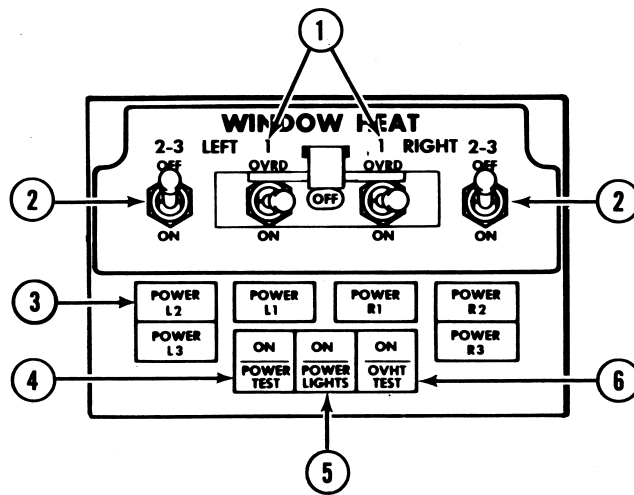
2. PROBE HEATER LIGHTS (Amber)

Comes on if probe heater is not receiving electric current regardless of Probe Heater switch position. PROBE HEAT light on center panel will also come on.

3. PROBE HEAT LIGHT (Amber)

Comes on if any probe heater is not receiving electric current.

WINDOW HEAT



1. NO. 1 WINDOW HEAT SWITCHES

ON position supplies heat for anti-icing and defogging. OFF position removes heat for and resets the system after an overheat trip. OVRD position (guarded) applies a reduced constant heat to the No. 1 windows for de-fogging only.

NOTE:

Window heat is not required for maintaining window impact strength.

2. NO. 2 & 3 WINDOW HEAT SWITCHES

On position applies heat to the window for defogging.

3. WINDOW HEAT POWER LIGHTS (Green)

Illuminated when window is being heated. The lights will cycle on and off as power is applied and removed from the window.

4. WINDOW HEAT POWER TEST SWITCH

The switch is pressed to apply power to the No. 1 window heat systems when the window heat switches are ON but the windows are above temperature control. It will illuminate the power lights if the systems are functional.

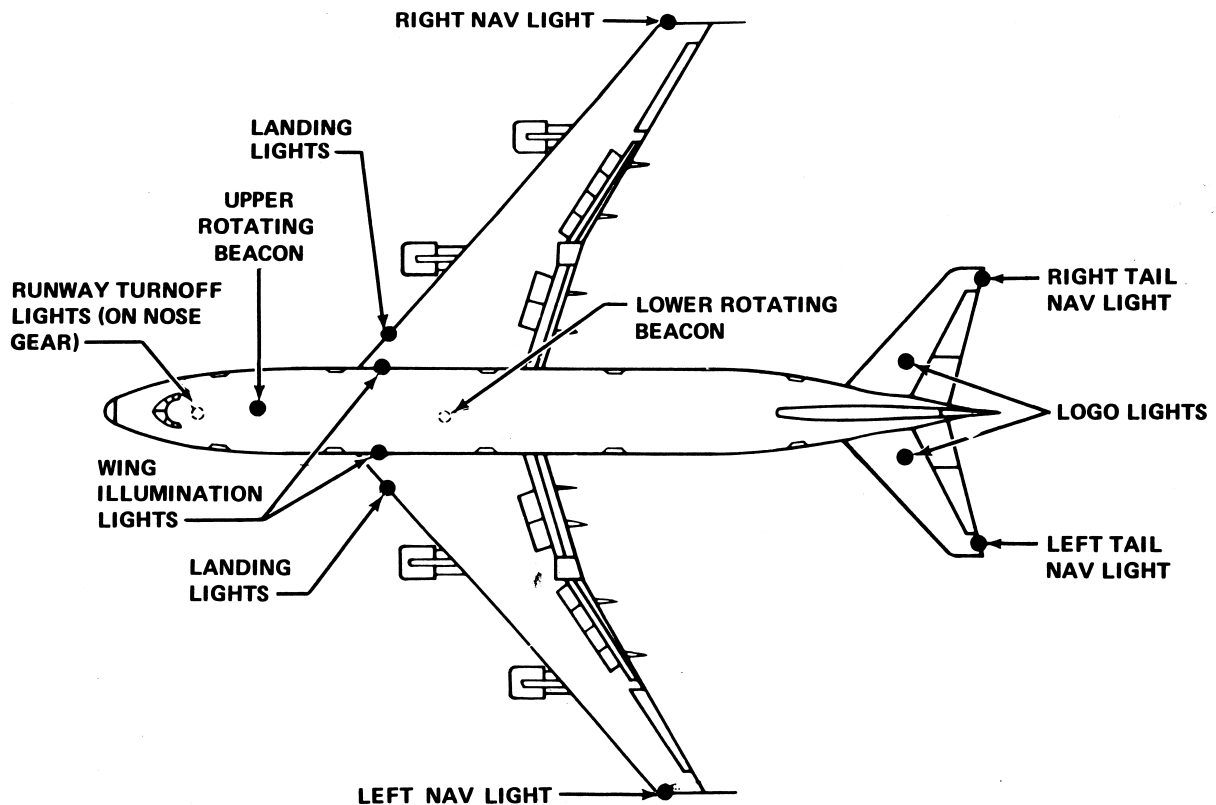
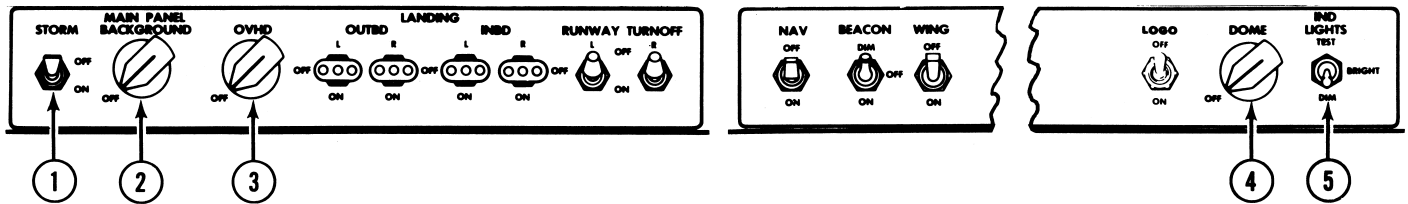
5. POWER LIGHTS SWITCH

Pressing the switch in locks it in to allow monitoring the power lights. Pressing the switch again releases it.

6. WINDOW OVERHEAT TEST SWITCH

The switch is held in to simulate an overheat condition of both the No. 1 windows when the power ON lights are illuminated. The power lights will extinguish and the window 1 OVHT light on the F/E's Door Annunciator Panel will illuminate indicating the overheat protection system is operating normally.

OVERHEAD LIGHT CONTROLS



Exterior lights are as shown. All exterior lighting is controlled from this panel as well as some interior lighting.

OVERHEAD LIGHT CONTROLS

1. STORM LIGHT SWITCH

Overrides background lighting switches to provide full intensity and turns ON three forward dome lights.

2. MAIN PANEL BACKGROUND LIGHT SWITCH

Controls the intensity of the Captain, F/O and Center Panel Background Lights

3. OVERHEAD PANEL LIGHT SWITCH

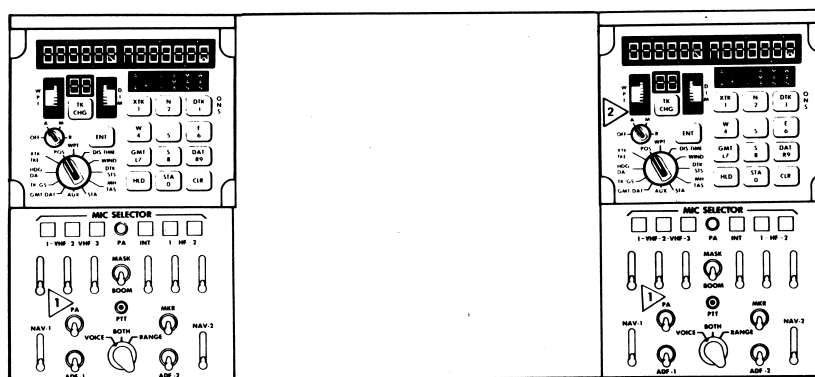
Controls the intensity of the Pilots' Overhead Panel lighting.

4. DOME LIGHT SWITCH

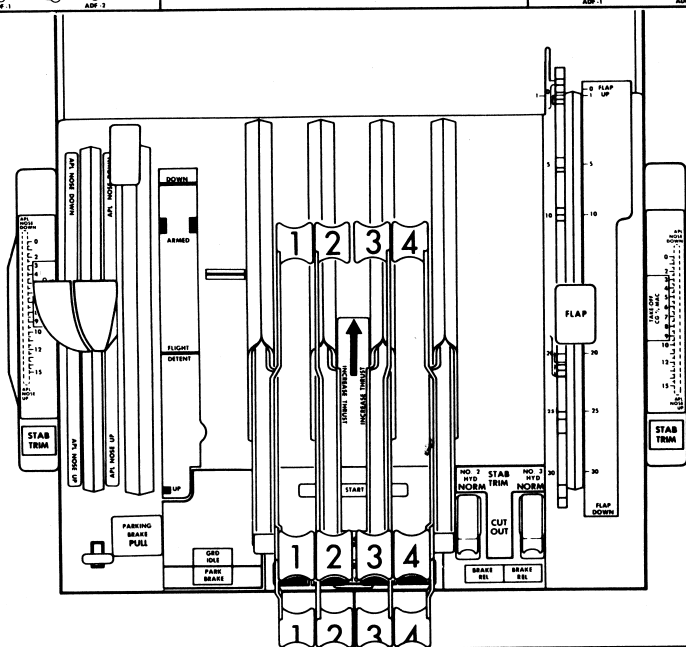
Controls the intensity of the Captain and F/O dome lights.

5. MASTER INDICATOR LIGHTS DIM AND TEST SWITCH

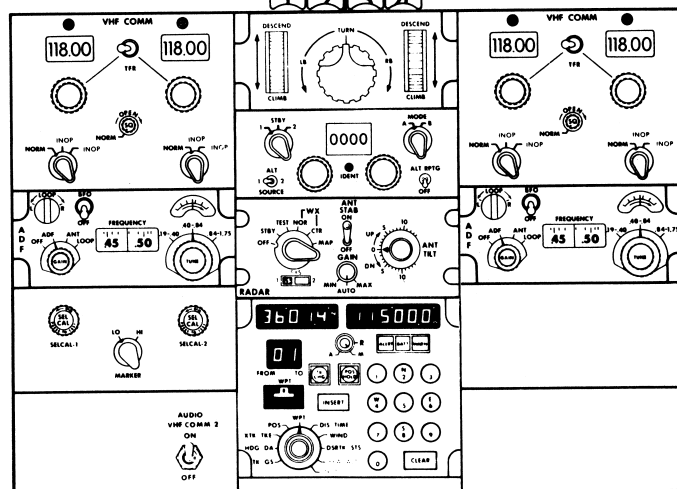
Controls intensity of all indicator lights on the pilot's panels in dim or bright position. Holding the switch in TEST position illuminates all indicator lights that do not have test capability such as MKR Beacon lights, etc.



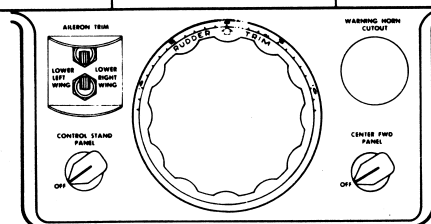
**FORWARD
ELECTRONICS
PANEL**



**CONTROL
STAND**

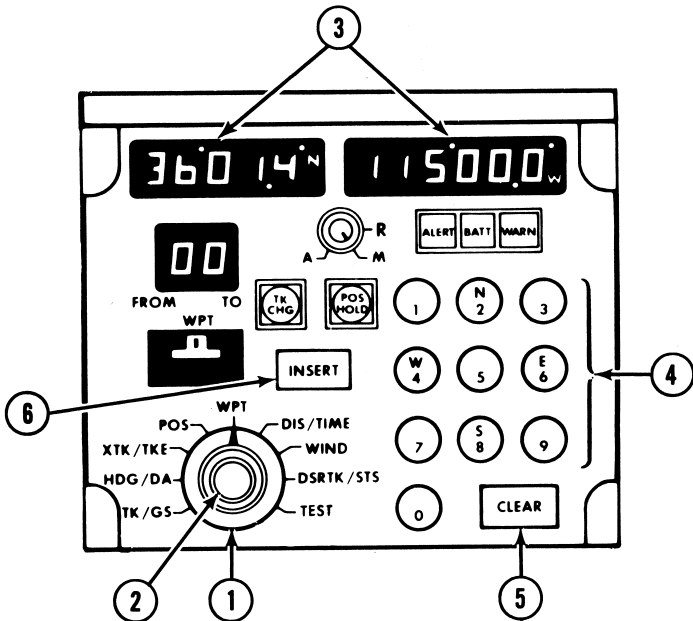


**AFT
ELECTRONICS
PANEL**



PILOT'S CONTROL STAND

INS CONTROL DISPLAY UNIT (CDU)



NOTE:

INS switch on Mode Selector Unit must be in STANDBY, ALIGN or NAV positions to activate.

1. DISPLAY SELECTOR SWITCH

Selects data for presentation on left and right numerical displays.

2. DISPLAY DIMMER CONTROL

Controls intensity of numerical and FROM/TO displays.

3. NUMERICAL DISPLAYS

Display data selected by display selector switch.

4. DATA KEYBOARD

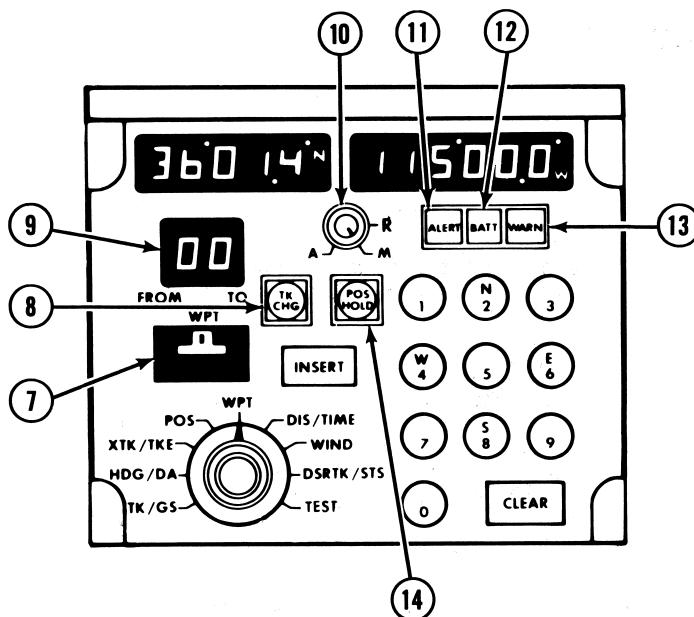
Provides ten keys (0 through 9) that are used to enter present position and waypoint coordinates and from/to waypoints. CLEAR key removes entered data if pressed before INSERT pushbutton is pressed.

5. CLEAR PUSHBUTTON

Pressing the button clears the undesired data entered on the display prior to insertion of data.

6. INSERT PUSHBUTTON

Transfers entered data into INS computer.



7. WPT SELECTOR SWITCH

When display selector switch is set to WPT, selects waypoint (1 through 9) for latitude and longitude insertion, or selects waypoint (0 through 9) for presentation of waypoint coordinates on left and right numerical displays.

8. TK CHG PUSHBUTTON

Allows initiation of manual track leg change.

9. FROM/TO WAYPOINT DISPLAY

Displays FROM waypoint number and TO waypoint number of track leg being navigated.

10. AUTO-MANUAL SELECTOR

In the auto position waypoints are sequenced automatically along a route. The manual position is used for manual waypoint change.

11. ALERT LIGHT

Comes on two minutes before each approaching to waypoint is reached and then either goes off thirty seconds before the waypoint is reached to signify that a track leg change is being automatically made (automatic operation) or flashes to indicate that a track leg change must be manually initiated (manual operation).

12. BATT LIGHT

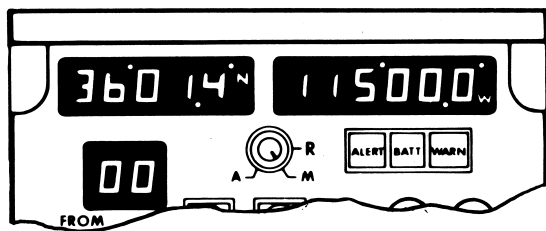
Comes on when the INS is operating on backup power.

13. WARN LIGHT

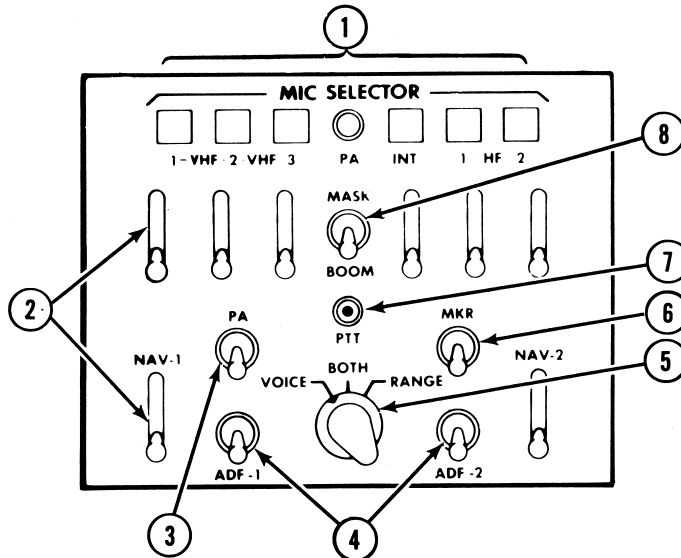
Comes on when a system malfunction occurs or, during the align mode, flashes to indicate that incorrect present position latitude is inserted or an INS alignment failure has occurred.

14. POS HOLD PUSHBUTTON

Holds present position on left and right numerical displays or initiates manual updating of present position.



AUDIO SELECTOR PANELS (ALL)



1. TRANSMIT SELECT SWITCH (7)

Pushing in selects transmitter, illuminates the light in the Button and releases other switches.

2. RECEIVE/VOLUME LEVERS

Individual receiver volume controls enables monitoring of any number of receivers at the individually desired levels.

3. PA MONITOR

Allows any PA to be monitored. There is no volume adjustment.

4. ADF MONITOR SWITCHES (2)

Allows monitoring of the selected ADF radios. There is no volume adjustment.

5. NAV AND ADF FILTER SWITCH

Selects the type of signal to be monitored. Range, Voice and DME signals are all monitored in the BOTH position. The switch is normally left in the BOTH position. VOICE position filters the range signals. RANGE position filters the voice signals.

6. MARKER SWITCH

Allows monitoring of the marker beacon. There is no volume adjustment.

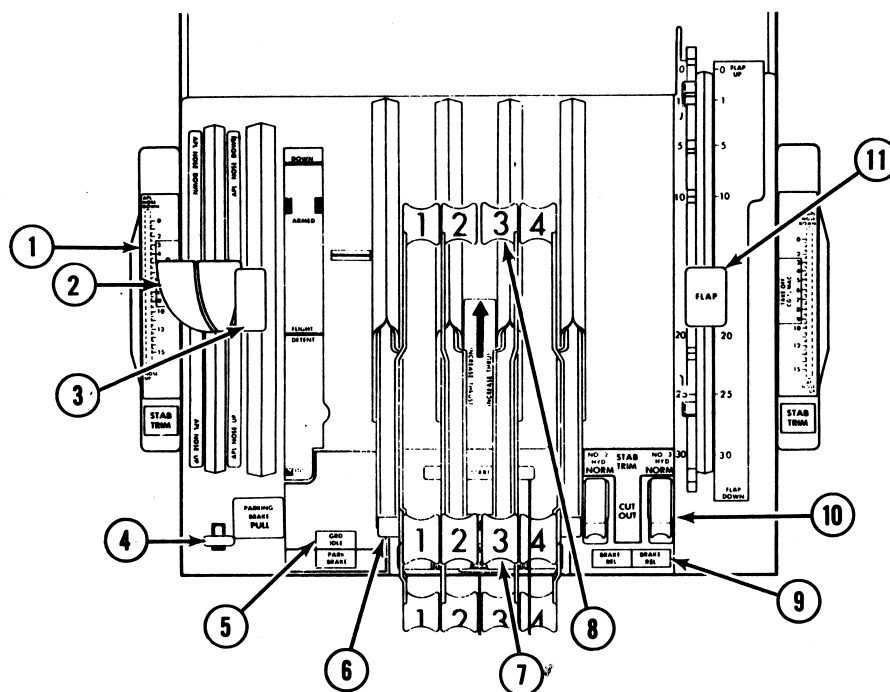
7. PUSH-TO-TALK SWITCH (PTT)

Used to key oxygen mask or boom microphone.

8. MASK/BOOM MICROPHONE SWITCH

Selects microphone to be keyed by PTT switches.

PEDESTAL



1. STABILIZER TRIM INDICATORS

Indicates the stabilizer position in terms of airplane trim. The green band indicates the allowable trim setting for take-off.

2. STABILIZER MANUAL TRIM LEVERS

Mechanically performs the same function as the electric trim switches but will override these switches and the autopilot, and can trim beyond the range of the trim switches and autopilot.

3. SPEED BRAKE LEVER

Fore and aft movement modulates the position of the speed brakes/spoilers. The lever will automatically move aft if, in the down position, the No. 2 or No. 4 reverse levers are actuated to the reverse interlock or if, in the armed position,

upon touchdown with the throttles closed. The lever will automatically move forward if No. 1 or No. 3 throttles are advanced beyond 50% thrust. A locking solenoid prevents movement past the flight detent while the landing gear is in the flight mode. In the ground mode, full aft movement to the up position is permitted. The lever may be manually actuated to override the automatic ground spoiler function. An intermittent horn will sound if the No. 3 throttle is advanced for take-off with the lever out of the full down position.

4. PARKING BRAKE LEVER

Holding the lever aft while applying the brakes sets the brakes and illuminates the adjacent red parking brake light indicating the parking brake valve is fully closed. Pressing the brake pedals will release the handle and open the brake valve.

5. GROUND IDLE LIGHT (Amber)

Illuminates on the ground when flaps are positioned 25 or 30. Illuminated in flight when the flaps are positioned to 25 or 30 when one or more engines have remained in the ground idle mode.

6. ENGINE START LEVERS

Controls electrically in cutoff, rich or idle positions the fuel and ignition to each engine. The rich position aids in starting a cold soaked engine below 0°C by allowing an increased rate of fuel flow.

7. THROTTLES

The throttles are mechanically connected to the fuel control units which in turn hydromechanically control fuel and airflow through each engine to provide desired thrust. There are throttle extensions for the Flight Engineer.

8. REVERSE THRUST LEVER

Movement up and aft provide fan thrust reversal. The movement of the levers is restricted unless the aircraft is on the ground and the throttles are in idle position. An interlock prevents reverse thrust application until the reverser reaches the full reverse position. Throttle movement is restricted until reversers are in the forward thrust position.

9. STABILIZER BRAKE RELEASE LIGHTS (Amber)

Illuminated when trimming indicates the trim motor brakes are released permitting the stabilizer to be trimmed.

10. STABILIZER HYDRAULIC SHUT-OFF SWITCHES

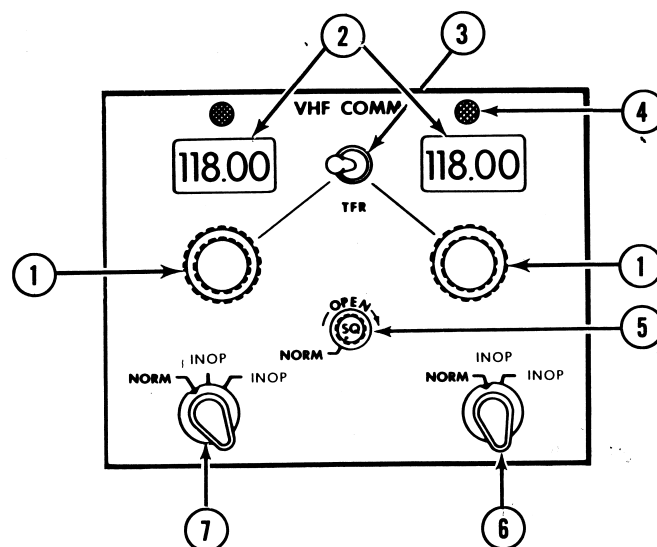
Shuts off the hydraulic pressure to the associated stabilizer trim control module. Placing both switches to cutout eliminates stabilizer trim.

11. FLAP LEVER

Movement of the lever into detents of 1, 5, 10, 20, 25, 30 provide means of extending or retracting the trailing edge and leading edge flaps to desired positions. Gates at detents 20 and 1 provide a mechanical means of alerting the pilot retracting the flaps, to check the airspeed prior to further retraction.

AFT ELECTRONICS PANEL

VHF



1. FREQUENCY SELECTORS (2)

Rotation of the selectors changes the displayed frequency in the adjacent window.

2. FREQUENCY INDICATORS (2)

Display frequency as set by the Frequency Selector.

3. FREQUENCY TRANSFER SWITCH

Permits selection of either the left or right hand displayed frequencies.

4. FREQUENCY TRANSFER LIGHT (Green)

Illuminates to indicate which frequency has been selected by the transfer switch.

5. SQUELCH CONTROL

Adjusts gain for optimum signal reception. Optimum control is in the norm (auto squelch position). With some units, auto squelch is provided continuously regardless of the control position.

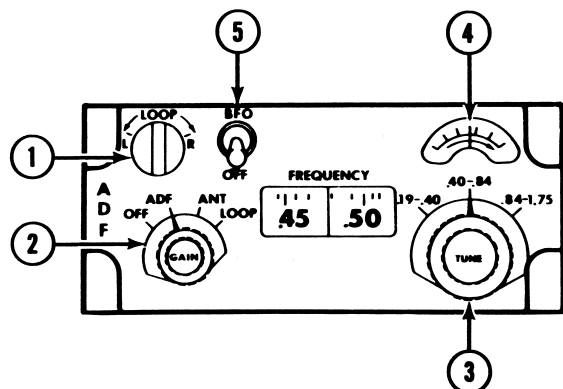
6. STATCOM PRE-AMP SELECTOR

(Provisions only — Equipment not installed.) Used to select normal or alternate SAT/COMM amplifier.

7. MODE SELECTOR

The selection is left in the normal positions. The other selections are provisions only.

ADF



1. LOOP POSITION CONTROL

Rotates the loop either left or right with the function switch in loop.

2. MODE SWITCH

ADF position provides bearing information on the RMI's. ANT position provides reception of audio signals only. LOOP selection provides use of the loop antenna to determine an aural null. A gain control is used to adjust for optimum signal reception.

3. FREQUENCY BAND SELECTOR

Used to select one of three bands of frequencies from which tuning can be manually accomplished. Located on top is the tuning knob which adjusts the adjacent frequency indicator.

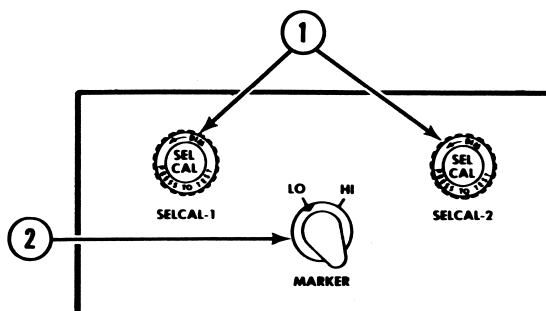
4. TUNING METER

Displays the maximum signal strength of the tuned signal by the amount of needle deflection. Minimum deflection indicates the most accurate aural null when the function switch is in the LOOP position.

5. BEAT FREQUENCY OSCILLATION SWITCH (BFO)

Selecting BFO position, a tone is provided for reception of unmodulated signals. This is used for precise tuning with the function switch in the ANT position.

SELCAL



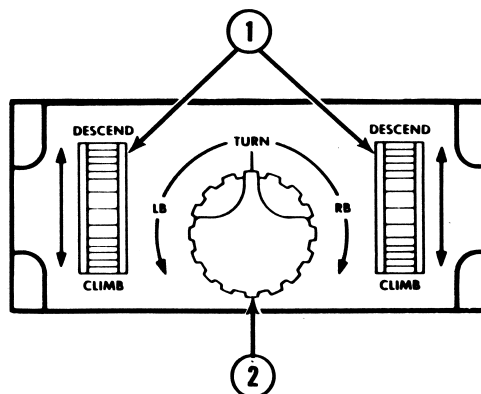
1. SELCAL LIGHTS (Blue)

Illuminated to alert the pilots of incoming calls. Selcal 1 monitors VHF-1 and HF-1. Selcal 2 monitors VHF-2 and HF-2. Upon reception of an incoming call, the selcal light illuminates and the chime will sound. Pressing the selcal light or keying the appropriate transmitter will silence the chime and extinguish the light. Receiver identification of the incoming call is determined by the receiver tuned to the selcal frequency.

2. MARKER BEACON SWITCH

Allows sensitivity adjustment of the marker beacon receiver.

AUTOPILOT MANUAL CONTROL MODULE



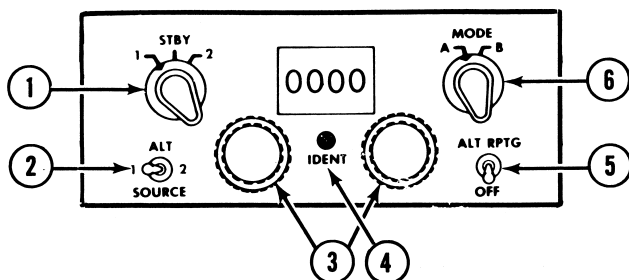
1. PITCH CONTROL

Used to maneuver the airplane in pitch with the autopilot engage switch in MAN. With the A/P in command, pitch controls are active unless the A/P is providing pitch commands.

2. TURN CONTROL

Used to maneuver the airplane in roll with the A/P engage switch in MAN. With the A/P in command, moving the turn control out of its detent will trip the A/P to MAN.

ATC TRANSPONDER



1. FUNCTION SELECTOR

STBY position allows warm up. Selection of either 1 or 2 selects the transponder for use.

2. ALTITUDE SOURCE SWITCH

Selects the CADC as the source for providing automatic altitude reporting signals.

3. CODE SELECTORS

Used to set transponder codes in the adjacent code display indicator.

4. IDENTIFICATION SWITCH

Pressed at request of ATC for positive identification. Illuminates green when pressed.

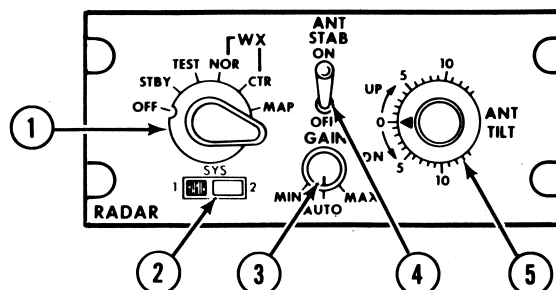
5. ALTITUDE REPORTING SWITCH

Turns altitude reporting signals on or off.

6. MODE SELECTOR

Set to mode A at all times. Altitude reporting capability is active through mode A if ALT RPTG is selected.

RADAR CONTROL PANEL



1. FUNCTION SELECTOR

Selects modes of operation. STBY position is provided for warm up of certain circuits. TEST position is for displaying a test pattern on the scope. NOR position provides for system activation and return signals on the scope. CTR is for highlighting intense returns. MAP position provides an increased depth of beam for mapping terrain. OFF position turns off all circuits.

2. SYSTEM SELECT SWITCH

Selects the Receiver/Transmitter unit and associated antenna stabilization input. Only one system is installed and the switch is safety wired to the No. 1 position.

3. GAIN CONTROL

Controls receiver sensitivity in MIN-MAX positions. AUTO position provides for automatic optimum control. AUTO position is normally selected.

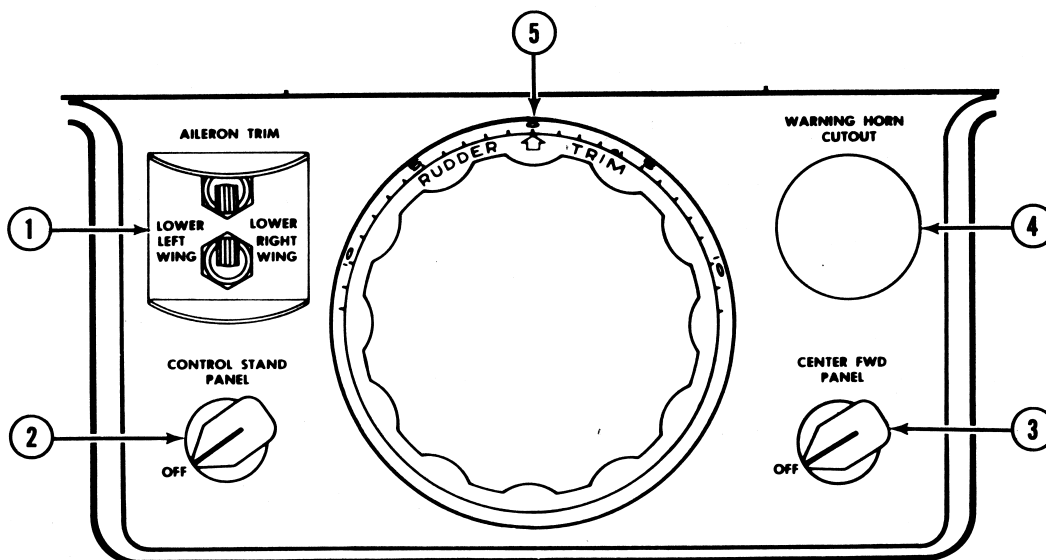
4. STABILIZATION SWITCH

ON position maintains a constant beam plane-of-rotation as selected by the tilt control. OFF position aligns the vertical axis of the antenna with the vertical axis of the airplane.

5. ANTENNA TILT CONTROL

Varies the plane-of-rotation of the beam from horizontal by tilting the antenna.

AFT PEDESTAL



1. AILERON TRIM SWITCHES

Electrically repositions the control system neutral position. Control wheels will be displaced from the neutral position. The upper switch arms the lower switch making it necessary to operate both switches together. Trim units are indicated on the control wheel.

2. CONTROL STAND PANEL LIGHT SWITCH

Controls the intensity of the lights on the Pilot's Control Stand, Forward and Aft electronic panels.

3. CENTER PANEL LIGHT SWITCH

Controls the intensity of panel lighting for the Pilots Center Panel.

4. LANDING GEAR WARNING HORN CUT-OUT SWITCH

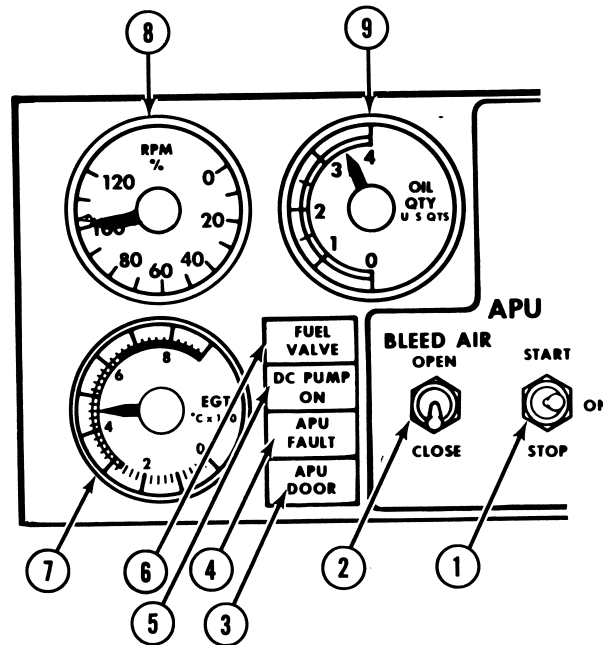
Pressing silences the horn and resets the warning system. The horn cannot be silenced with the flaps set at 25 or 30, regardless of throttle position, with any landing gear not down and locked.

5. RUDDER TRIM WHEEL

Rotating displaces the rudder in varying amounts depending on the airplane speed.

FLIGHT ENGINEER'S UPPER AND LOWER PANEL

APU PANEL



1. APU MASTER SWITCH

ON position starts the AC or DC fuel pump in No. 2 main tank, opens the APU fuel valve and opens the APU door. Holding momentarily to the START position initiates starter motion cranking and further automatic control. The STOP position signals shutdown and resets the circuits for another start.

2. BLEED AIR SWITCH

The OPEN position provides bleed air to the pneumatic manifold above 95% RPM. The CLOSED position holds the bleed air valve closed.

3. APU DOOR LIGHT (Blue)

Illuminates while the APU door is in transit.

4. APU FAULT LIGHT (Amber)

Illuminates to indicate an automatic shutdown caused by excessive EGT, overspeed or internal fault. It will also illuminate during normal shutdown until the APU door reaches the CLOSED position.

5. DC PUMP ON LIGHT (Green)

Illuminated when the DC fuel pump is operating.

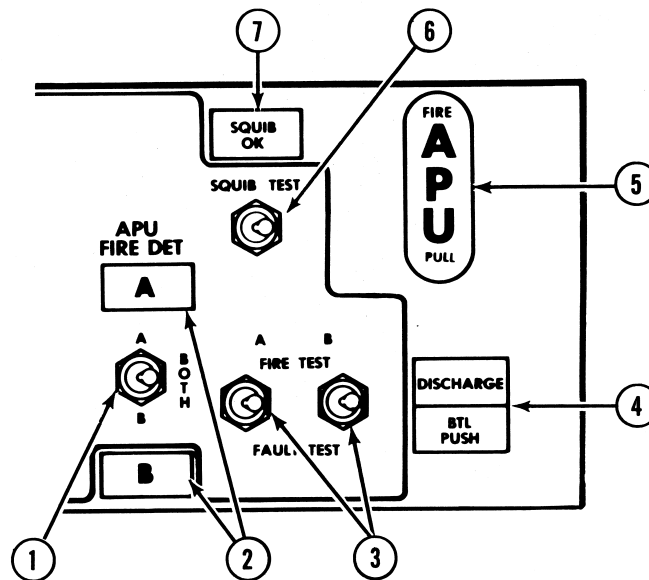
6. APU FUEL SHUTOFF VALVE LIGHT (Blue)

Illuminated while valve is in transit. It will not illuminate if only Battery Power is available.

7. EGT INDICATOR

8. APU RPM INDICATOR

9. OIL QUANTITY INDICATOR



1. APU FIRE DETECTOR SWITCH

Selects A, B or A and B Fire Detection loops to initiate a fire warning.

2. APU FIRE DETECTION SYSTEM FAULT LIGHTS (Amber)

Illuminates to indicate a fault (short circuit) and during a fault test to indicate that detectors are operational.

3. APU FIRE/FAULT TEST SWITCHES

The switches are spring loaded OFF. The fire handle, APU, and master fire warning lights will illuminate and the fire warning bell will sound, when the switches are held in the fire test position. Holding the switches down will illuminate the A and B fault lights.

4. APU EXTINGUISHER DISCHARGE SWITCH (Amber)

The switch is armed when the fire handle is pulled. Pressing discharges the fire extinguisher. The light illuminates to indicate the extinguisher has discharged.

5. APU FIRE HANDLE

Illuminates for an APU fire or fire test. Pulling the handle shuts down the APU and arms the fire extinguisher circuit. When pulled, a yellow flag rotates into view and locks the handle in the pulled position.

6. APU SQUIB TEST SWITCH

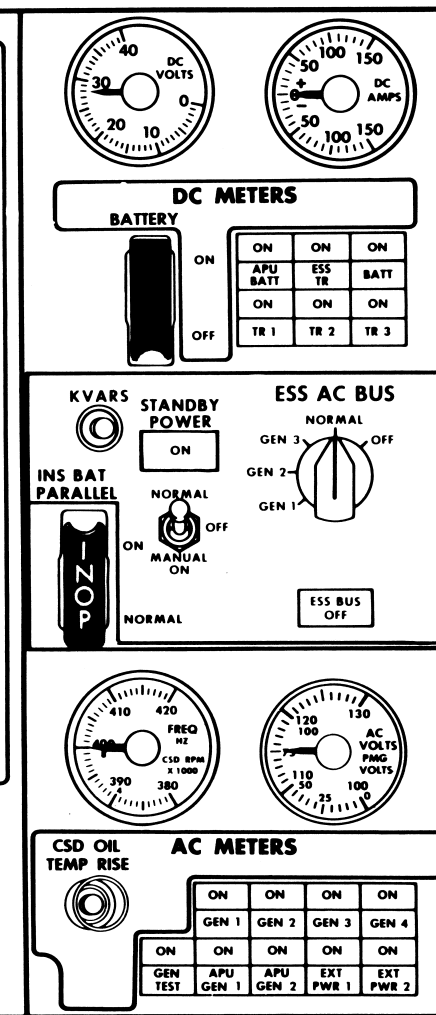
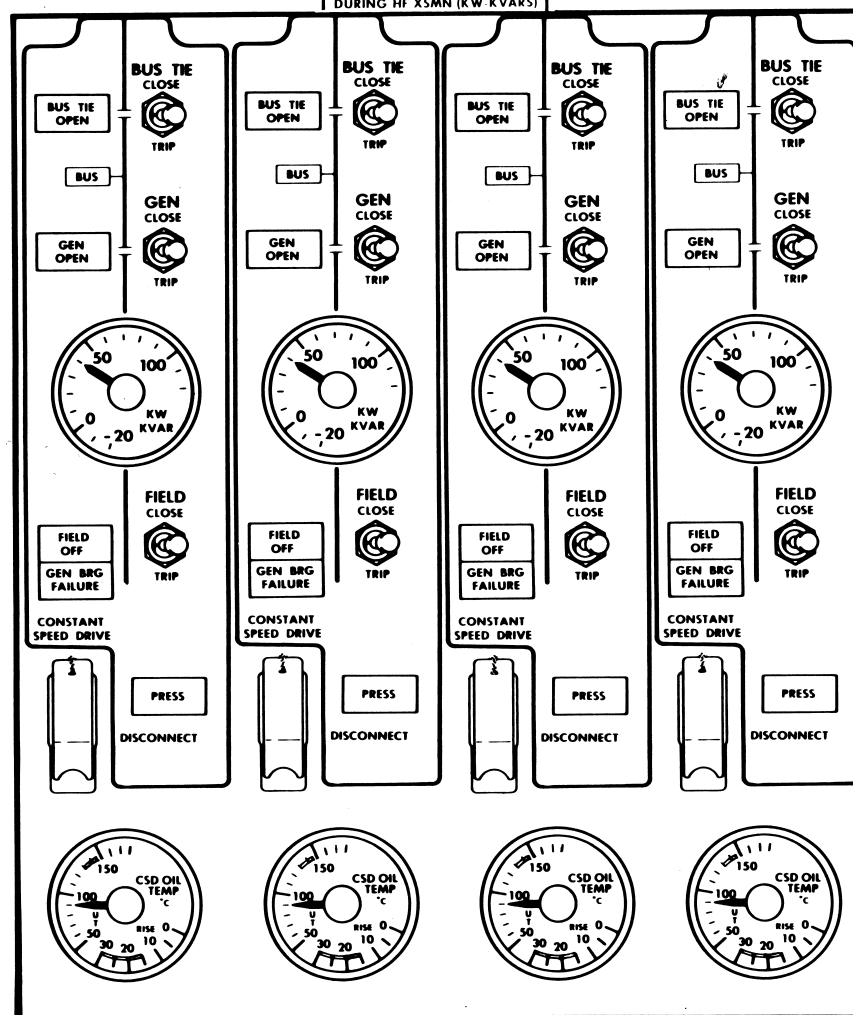
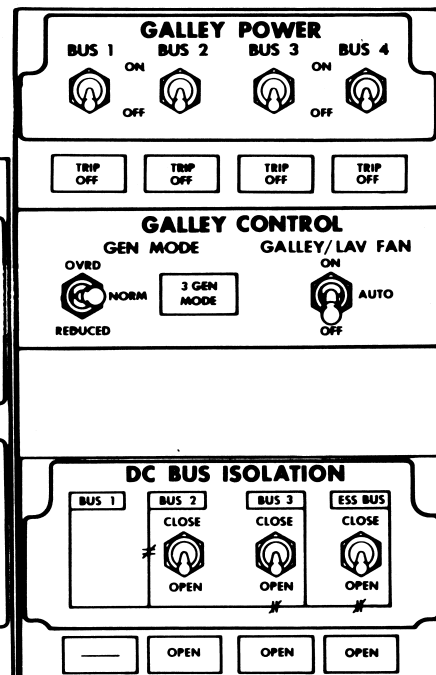
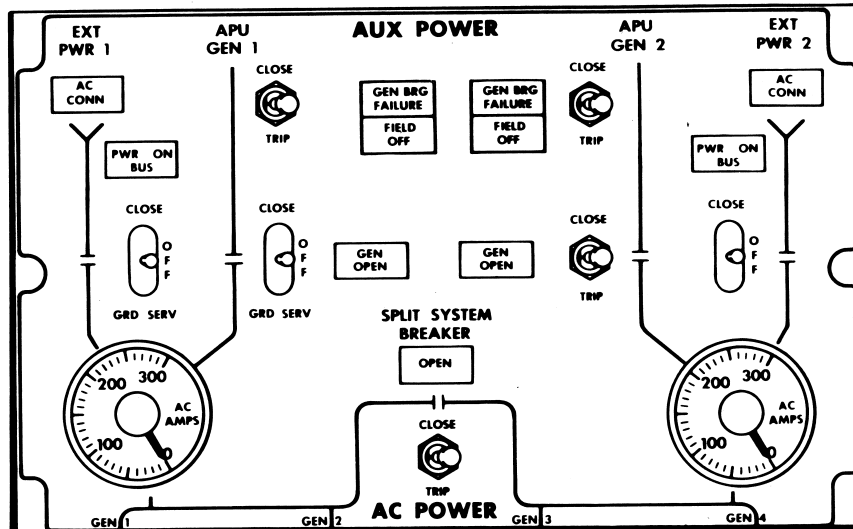
When held to the "TEST" position, it energizes the squib circuit and illuminates the squib test light.

7. APU SQUIB TEST LIGHT (Green)

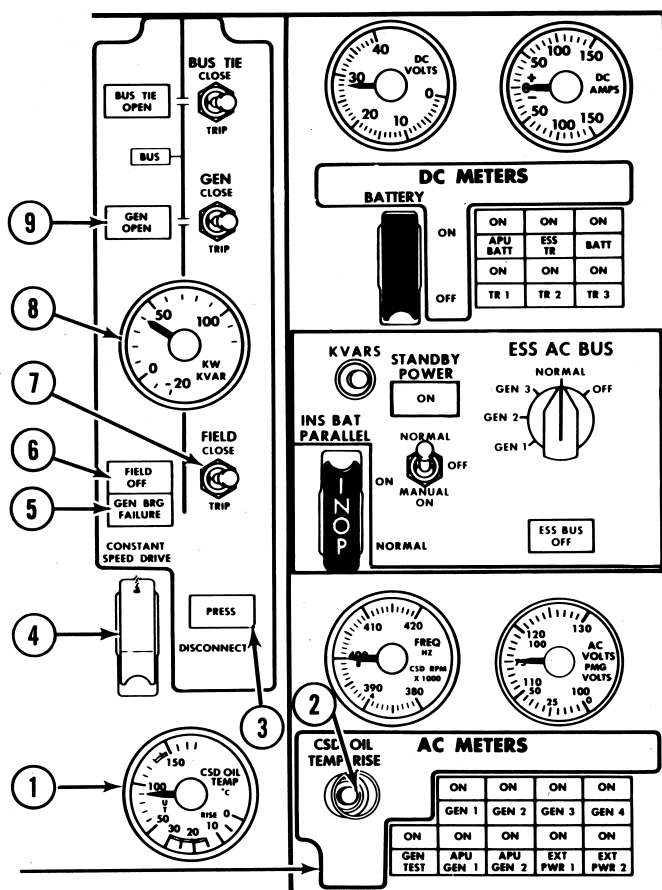
Illuminates during a test of the extinguisher squib circuit to indicate the circuit is operational.

ELECTRICAL PANEL

AUX POWER PANEL



MAIN ELECTRICAL PANEL



1. CSD OIL TEMPERATURE INDICATORS

Reads the CSD oil temperature as it leaves the CSD.

2. CSD OIL TEMP RISE SWITCH

Pressing Rise Switch will cause Oil Temperature Indicators to read temperature rise thru the CSD's.

3. CONSTANT SPEED DRIVE (CSD) LOW PRESSURE LIGHTS (Amber)

Illuminates when the CSD oil pressure is low.

4. CSD DISCONNECT SWITCHES

Guarded for normal operation. The momentary DISCONNECT position mechanically disconnects the CSD drive unit.

5. GENERATOR BEARING FAILURE LIGHTS (Amber)

Illuminates for an impending generator bearing failure.

6. GENERATOR FIELD OFF LIGHTS (Amber)

Illuminates if the generator field is deactivated.

7. GENERATOR FIELD SWITCHES

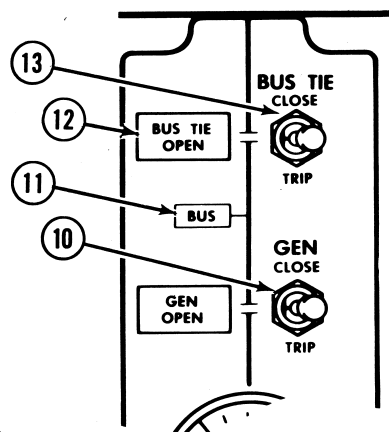
The momentary CLOSE position activates the generator field. Momentarily held in the TRIP position, deactivates the generator field.

8. KW/KVAR METERS

Reads generator loads in KW's. While pressing the KVAR switch, reactive loads may be read in KVAR's.

9. GENERATOR BREAKER OPEN LIGHTS (Amber)

Illuminates if the generator is disconnected from its AC BUS.



10. GENERATOR BREAKER SWITCHES

The momentary CLOSE position connects the generator to the AC bus. Momentarily held in the TRIP position, disconnects the generator from the AC bus. Automatic paralleling is accomplished by closing two or more.

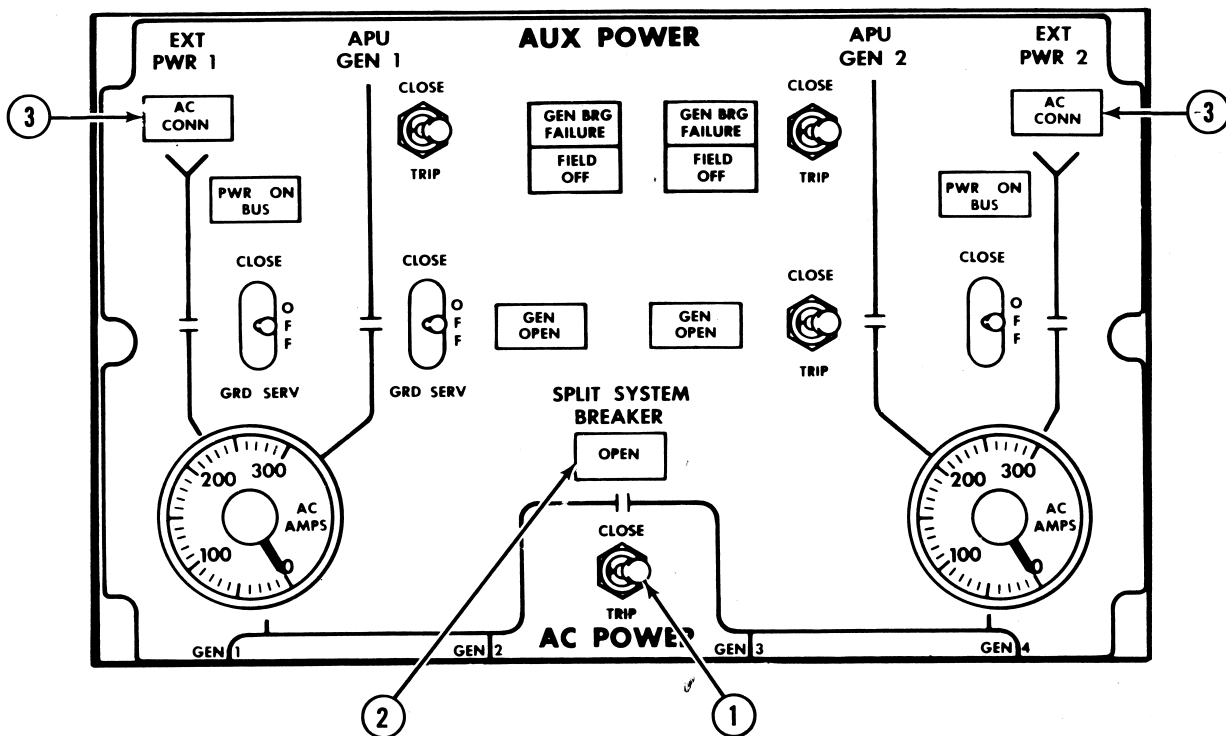
11. MAIN AC BUS PLACARDS

12. BUS TIE BREAKER OPEN LIGHTS (Amber)

Illuminates if the AC bus is not connected to the Sync Bus.

13. BUS TIE BREAKER SWITCHES

The momentary CLOSE position connects the AC bus to the sync bus. Momentarily held in the TRIP position, disconnects the AC bus from the Sync Bus. Manual paralleling is accomplished by closing the Bus Tie Breakers.



1. SPLIT SYSTEM BREAKER

The momentary CLOSE position parallels engine driven generators No. 1 and No. 2 with No. 3 and No. 4. The momentary OPEN position splits the Sync Bus dividing the electrical system into two paralleled systems. The OPEN position permits power sources with no paralleling capability to power opposite sides of the Sync Bus. The CLOSED position allows one auxiliary power source to power the entire Sync Bus.

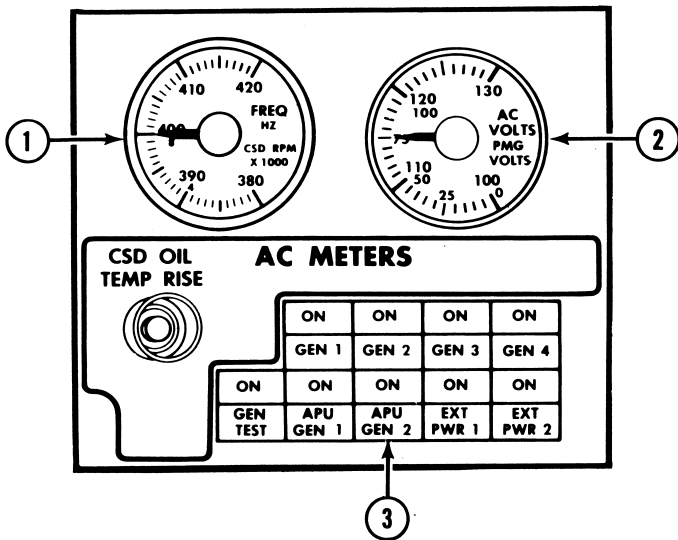
2. SPLIT SYSTEM BREAKER LIGHT (Green)

Illuminates when the SSB is open.

3. EXTERNAL POWER CONNECTED LIGHTS (White)

Illuminates with external power connected to the airplane.

AC METERS



1. FREQUENCY METER

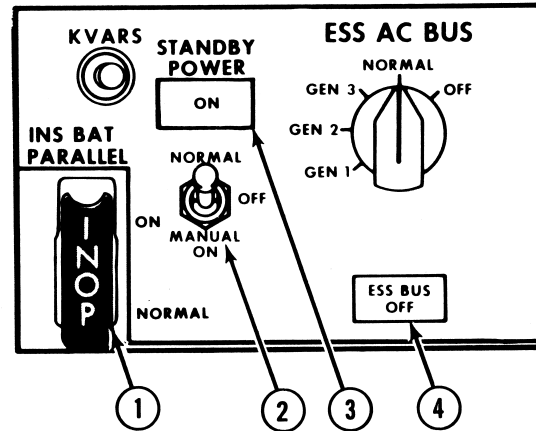
Indicates the frequency (Hz) output of the selected generator or it will indicate the CSD RPM when the GEN TEST switch is pressed in conjunction with a selected generator.

2. AC VOLTMETER

Indicates the voltage output of the selected generator or it will indicate the permanent magnet generator voltage when the GEN TEST switch is pressed in conjunction with a selected generator.

3. AC METER SWITCHES

Any generator (APU, External or Engine Driven) may be selected for a readout of voltage and frequency. The GEN TEST switch is pressed to give a readout of PMG voltage and RPM of the selected engine driven generator or PMG voltage only for an APU generator.



1. INS BATT PARALLELLING SWITCH

Inoperative.

2. STANDBY POWER SWITCH

Allows automatic or manual transferring of the Standby Power source from Essential Busses to battery. The OFF position removes all power from the standby busses.

3. STANDBY POWER ON LIGHT (Green)

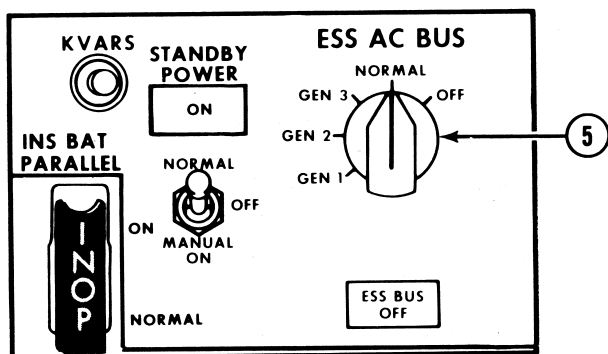
Illuminates when the Standby Static Inverter is operating indicating the Standby Busses are being powered by the battery. Loss of Essential DC automatically transfers the power source from the Essential Busses to the battery. (Standby Power Switch is in the "NORMAL" position.) The light will also illuminate any time the "MANUAL ON" position is selected.

NOTE:

Battery switch must be "ON".

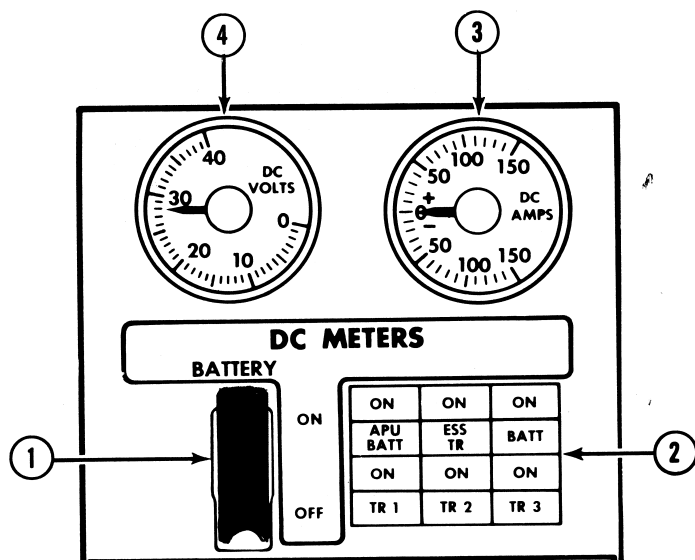
4. ESSENTIAL BUS OFF LIGHT (Amber)

Illuminates if the Essential AC bus is not powered. A repeater light is on the Pilot's Annunciator Panel.



5. ESSENTIAL AC BUS SELECTOR

Selects the power source for the Essential AC Bus. In the NORMAL position the Essential Bus is being powered by the No. 4 Main AC Bus. In Positions 1, 2 or 3 the Essential Bus receives power directly from the selected generation. Priority of selection is 3-1-2. The OFF position removes power from the Essential AC bus.



1. BATTERY SWITCH (GUARDED TO ON)

ON position allows the main battery to provide back-up power to the Battery Bus. It also connects the APU batteries to the APU. The OFF position isolates the main battery from all loads except the Hot Battery Bus. The OFF position also isolates the APU batteries from the APU and if the APU is running it will shut down when OFF is selected.

2. DC METERS SWITCHES

Pressing the switches connects the DC meters to the source of power selected for readout. A light illuminates in the switch when it is pressed. The selections are: APU Battery, ESS TR, BATT (Main), TR 1, TR 2 & TR 3.

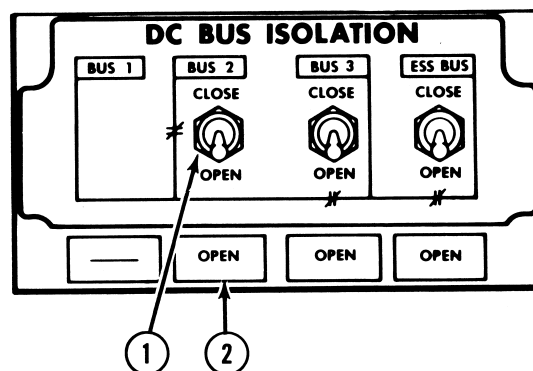
3. DC AMPS METER

Indicates TR amperage load or battery charge/discharge.

4. DC VOLTS METER

Indicates DC Bus Voltage or Battery Voltage/Condition.

DC BUS ISOLATION



1. DC BUS ISOLATION SWITCHES

The DC busses are isolated when the switches are in the OPEN position as placarded.

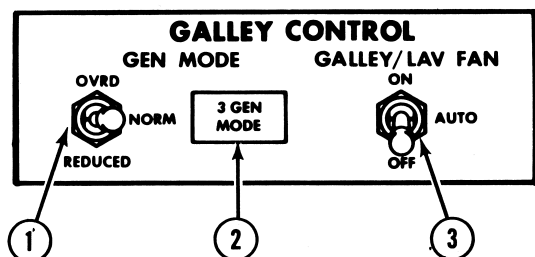
2. DC BUS ISOLATION RELAY OPEN LIGHTS (Green)

Illuminate when the corresponding isolation switch is placed to the OPEN position. BUS 3 OPEN light illuminates automatically when the Essential Power Switch is moved to the 3, 2 or 1 position.

NOTE:

Some aircraft have a blocking diode which prevents the DC Essential Bus from powering 1, 2 or 3. The Bus 3 open light will not illuminate automatically if the blocking diode is installed.

GALLEY CONTROL



1. GENERATOR MODE SWITCH

In the NORMAL position, the galley power maximum load is automatically reduced when any engine driven generator breaker switch is open. OVRD position will manually bypass the automatic feature and restore full galley power if a generator breaker is open. The REDUCED position manually reduces the load.

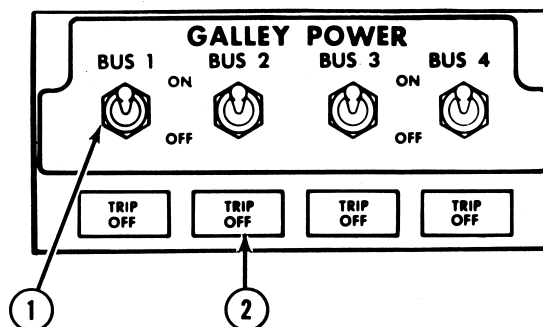
2. GENERATOR MODE LIGHT (Amber)

Illuminates when any engine driven Generator Breaker switch is open or when the mode switch is in the REDUCED position.

3. GALLEY/LAV FAN

ON position operates the fan continuously. AUTO operates the fan up to 6.8 pressure differential and the OFF position turns the fan OFF. The fan will automatically turn OFF anytime a fire warning light is illuminated on the Lower Lobe Galley Fire Protection Panel. It is reset by turning the switch to OFF and then back to ON or AUTO.

GALLEY POWER CONTROLS



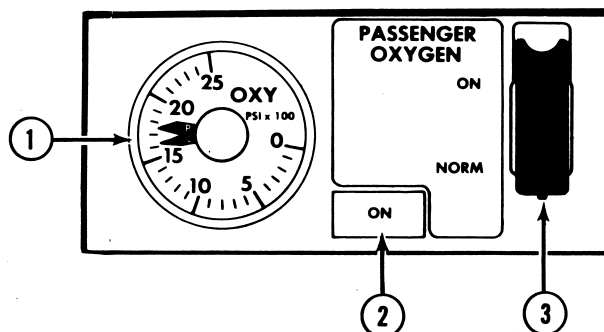
1. GALLEY POWER BUS SWITCHES

Galley power is connected to its associated AC bus when the switches are in the ON position.

2. GALLEY POWER TRIP OFF LIGHTS

Illuminates if the Galley Bus has automatically tripped off. Recycling the switch resets the circuit.

OXYGEN



1. OXYGEN PRESSURE INDICATOR

Dual pointers display pressure of the crew and passenger systems. The pointers are marked "C" for crew and "P" for passenger.

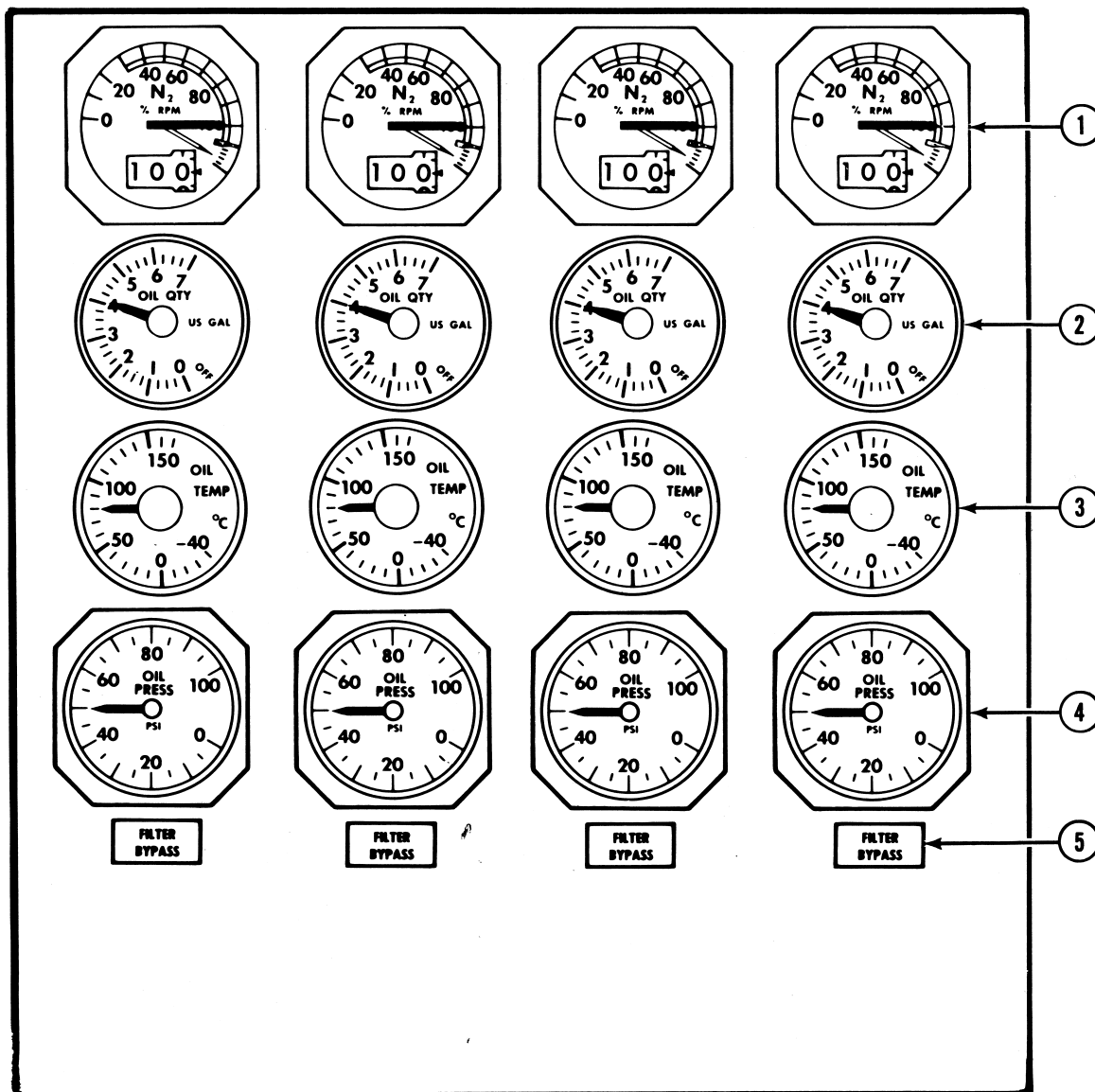
2. PASSENGER INDICATOR LIGHT (Amber)

Illuminates when the system is activated. A repeater light is on the Pilot's Annunciator Panel.

3. PASSENGER OXYGEN SWITCH

The switch is guarded and safetied in the NORM position for automatic deployment of passenger oxygen masks at 14,000 feet cabin altitude. The ON position deploys the masks regardless of cabin altitude.

F/E ENG. INDICATING INSTRUMENTS



1. N₂ RPM INDICATORS

Indicates percent of RPM of the high pressure compression with a pointer and digital readout. A maximum Indication Pointer registers overspeed and remains at the highest reading until it is reset. A yellow flag will drop over the Digital Readout Window with power loss or instrument failure.

2. OIL QUANTITY INDICATORS

Indicates quantity of usable oil in each tank. The pointer goes to OFF with loss of electrical power.

3. OIL TEMPERATURE INDICATORS

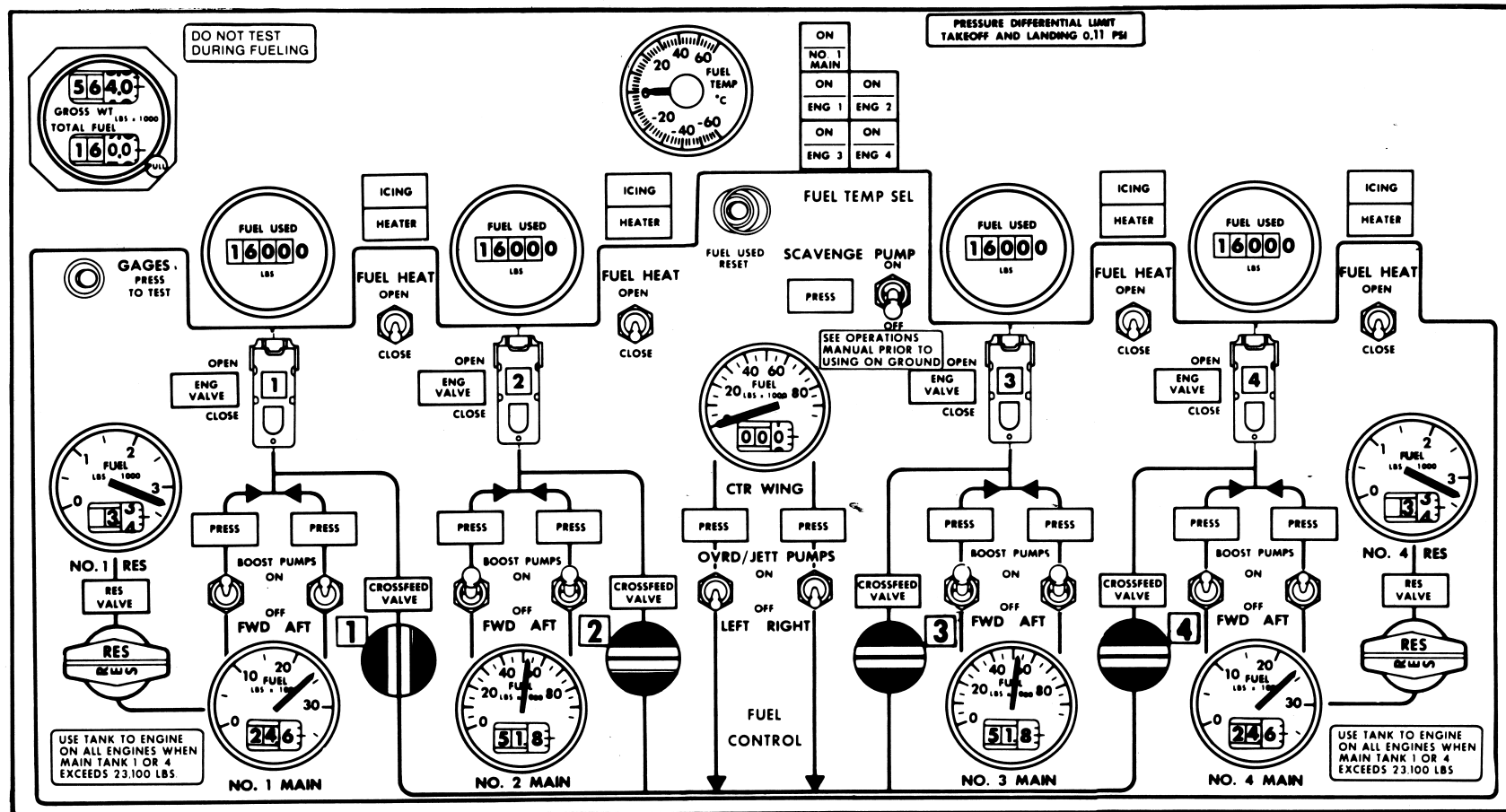
Indicates the temperature of the oil leaving the oil cooler.

4. OIL PRESSURE INDICATORS

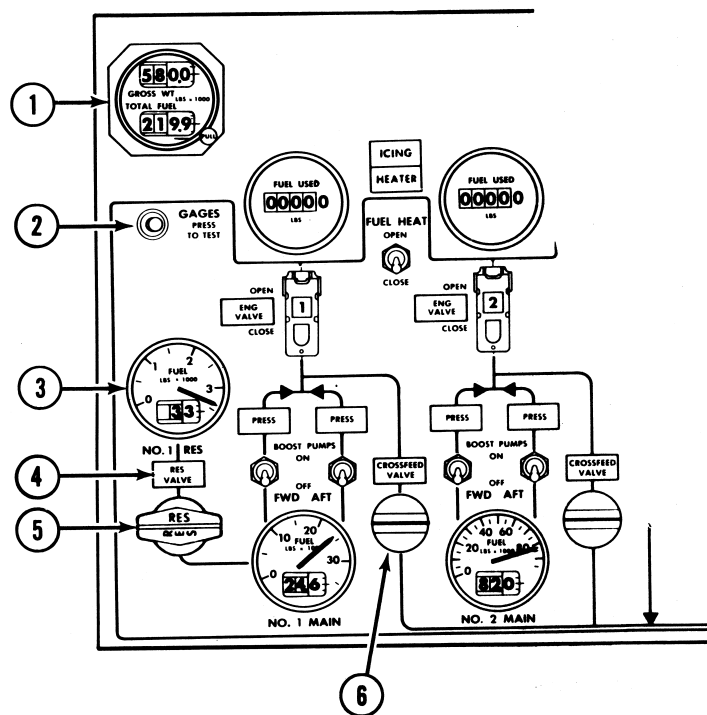
Indicates the oil pressure after leaving the oil cooler.

5. FILTER BYPASS LIGHTS (Amber)

Illuminates for an impending or actual main oil filter bypass condition.



FUEL PANEL



1. GROSS WEIGHT/TOTAL FUEL WEIGHT INDICATOR

Indicates gross weight in the top digital readout and total fuel weight in the lower digital readout. Both indicators decrease as fuel is burned off, and when the Quantity Test Switch is pressed.

2. FUEL QUANTITY TEST SWITCH

When pressed to TEST, all fuel quantity indicator readings will decrease. When the switch is released, all indicators will return to the original reading.

3. FUEL QUANTITY INDICATORS

Indicates individual tank quantity with a pointer and digital readout.

4. RESERVE FUEL VALVE LIGHT (Blue)

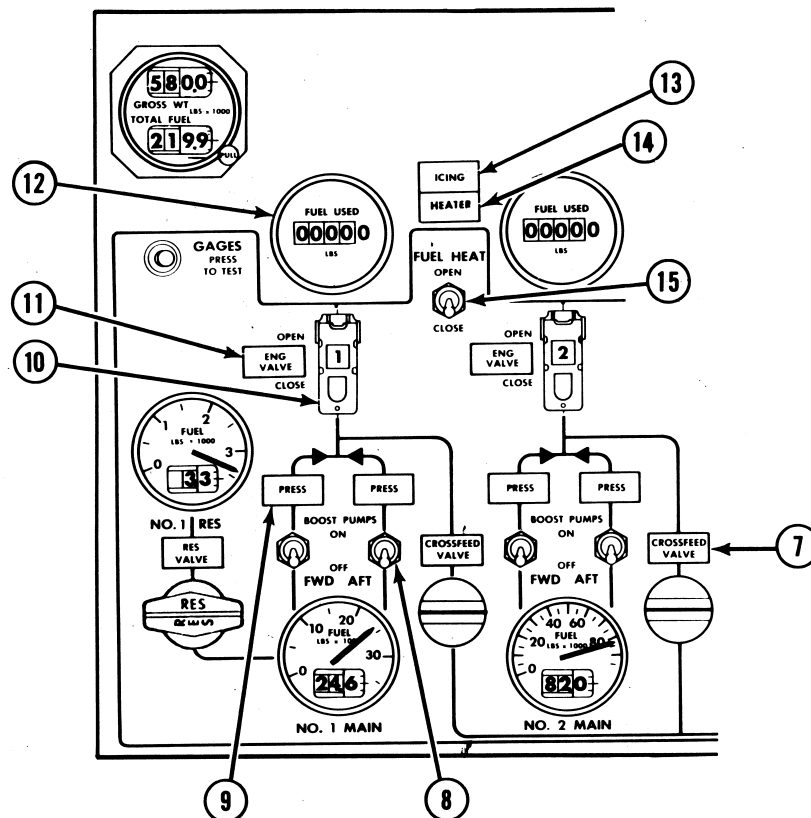
Illuminated when the Transfer Valve is in transit to the fully OPEN or CLOSED position. The light will be out when the valve is in the full open or closed position.

5. RESERVE TANK FUEL TRANSFER SWITCHES (2)

A yellow rotating switch referenced OPEN or CLOSED by a line across the switch. With the line in the vertical OPEN position, the Transfer Valve is open and reserve fuel gravity feeds into the adjoining Outboard Main Wing Tank.

6. FUEL CROSSFEED SWITCHES (4)

A rotating switch referenced OPEN or CLOSED by a line across the switch. With the line in the vertical open position, the Engine Fuel System is connected to the Crossfeed Manifold.



7. CROSSFEED VALVE LIGHTS (Blue)

Illuminated when the Crossfeed Valve is in transit to the fully OPEN or CLOSED position. It will be extinguished when the valve is fully opened or closed.

8. FUEL BOOST PUMP SWITCHES (8)

Controls operation of the two Boost Pumps in each Main Wing Tank and supplies fuel to the engines and/or crossfeed manifold. The number 2 Aft Boost Pump operates independent of the switch when AC power is available and the APU Master Switch is on.

9. FUEL BOOST PUMP LOW PRESSURE LIGHTS (Amber)

Illuminate to indicate low fuel pressure for the associated boost pump (pump ON or OFF).

10. ENGINE FUEL SHUTOFF SWITCHES (4)

OPEN position. The OPEN position allows operation of the valves with the Start Levers or Engine Fire Switches. When CLOSED, it isolates the engine from all fuel supply.

11. FUEL SHUTOFF VALVE LIGHTS (White)

Indicates Fuel Shutoff Valve position. Illuminates bright to indicate the valve is in transit. Dim when the valve is closed and it is extinguished when the valve is open.

12. FUEL USED INDICATORS (4)

Indicates fuel used by its associated engine on a Digital Indicator.

13. FUEL ICING LIGHTS (Amber)

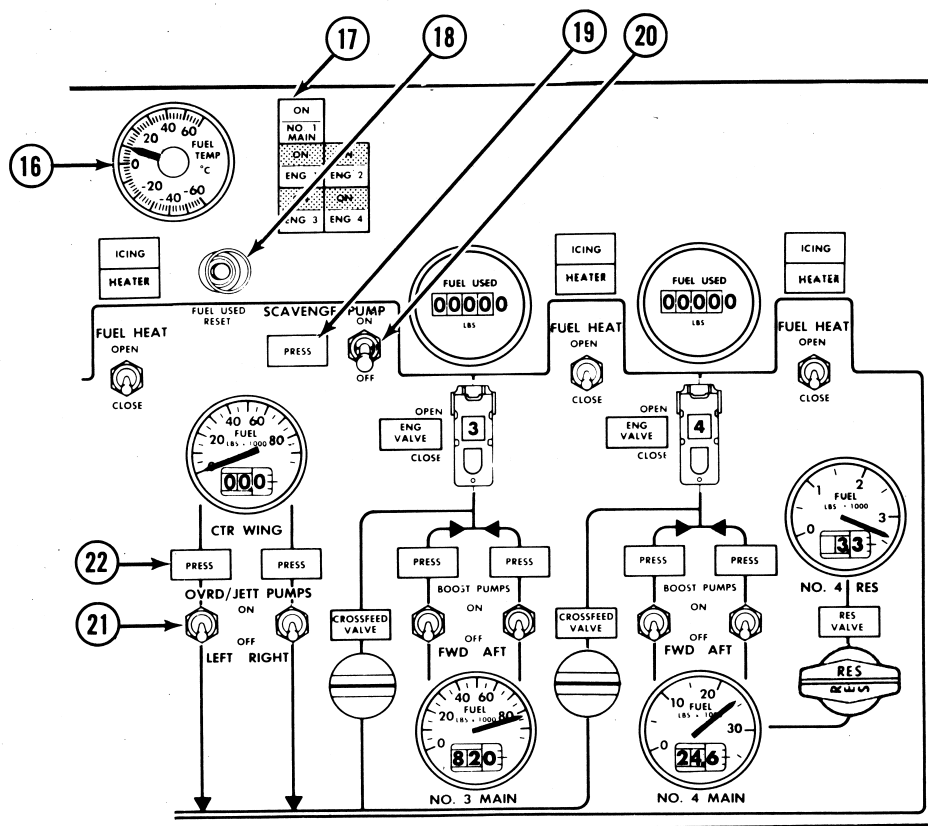
Illuminates to indicate a Fuel Filter obstruction caused by ice or foreign material in the associated engine fuel system.

14. FUEL HEATER LIGHTS (4)

Comes on when fuel heat switches are in the open position.

15. FUEL HEAT SWITCHES (4)

Controls the valve which provides engine bleed air to heat the fuel for the associated engine.



16. FUEL TEMPERATURE INDICATOR

Indicates readouts as selected by the Indicator Switches.

17. FUEL TEMPERATURE INDICATOR SWITCHES

The switches are pressed to read fuel temperature downstream of the fuel heater or at the No. 1 main wing tank. The white ON light will illuminate to indicate which selection has been made.

18. FUEL USED RESET SWITCH

Press to reset Fuel Used Indicators.

19. SCAVENGE PUMP LOW PRESSURE LIGHT (Amber)

Illuminates to indicate low fuel pressure but will momentarily illuminate when the pump is turned on. The light is disarmed with the pump switch off.

20. SCAVENGE PUMP SWITCH

Controls the Scavenge Pump, Feeds otherwise unusable fuel from the Center Wing Tank to the No. 2 Main Wing Tank.

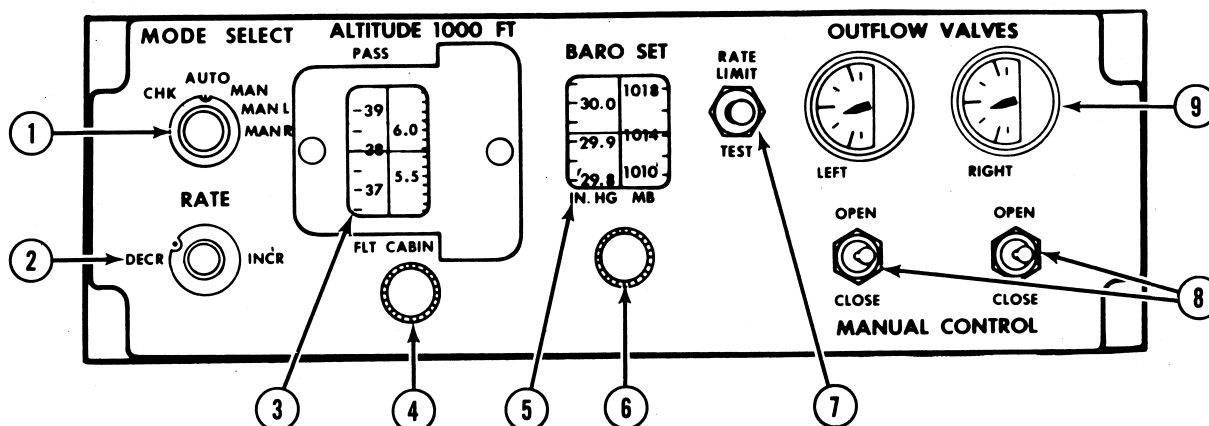
21. OVERRIDE/JETTISON PUMP SWITCHES (2)

Controls operation of the Override Jettison Pumps to supply fuel from the Center Wing Tank to the Crossfeed Manifold or Jettison Manifold. The pumps will override the output of the Boost Pumps when the associated Crossfeed Valve is open.

22. OVERRIDE/JETTISON PUMP LOW PRESSURE LIGHTS (Amber)

Illuminate to indicate low fuel pressure for the associated OVRD/JETT pump (pump ON or OFF).

PRESSURIZATION CONTROL



1. PRESSURIZATION MODE SWITCH

Selects Automatic (AC) or Manual (DC) mode of operation to control the Outflow Valves. The CHK position is for maintenance test. In AUTO, a rate sensing monitor will detect excessive rates of climb or descent in cabin altitude and will automatically assume pressurization control.

2. PRESSURIZATION RATE SWITCH

Selects the rate of climb on descent of cabin altitude in the AUTO mode. If the selector is at the Index mark, a 500 FPM cabin climb or 300 FPM descent will be maintained.

3. FLIGHT/CABIN ALTITUDE INDICATOR

Indicates on a dual scale tape Cabin Altitude corresponding to FLT altitude at the maximum AUTO differential pressure of 8.9 psi.

4. FLIGHT/CABIN ALTITUDE SELECTOR

Used to set the Flight/Cabin tape.

5. BARO SET INDICATOR

Indicated on a dual scale tape pressure in inches as well as millibars.

6. BARO SET KNOB

Used to set pressure on the Baro Set Indicator.

7. RATE LIMIT TEST SWITCH

Tests for the proper function of the Pressurization Rate Monitor System.

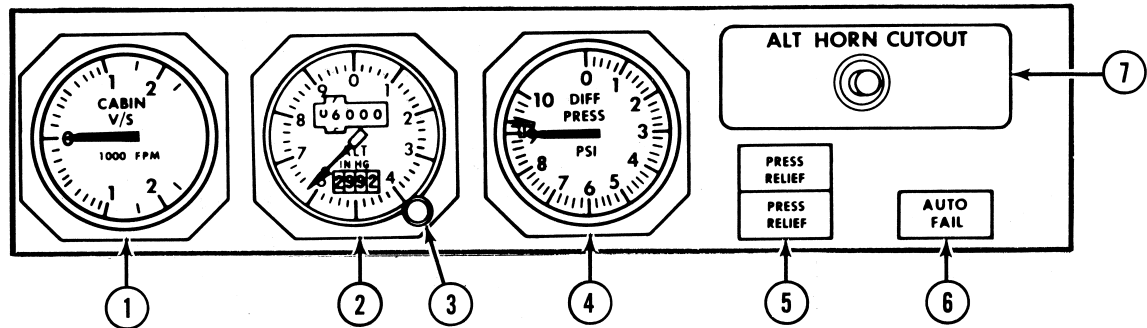
8. OUTFLOW VALVE MANUAL CONTROL SWITCH

Used in the Manual modes of operation to control the position of the Outflow Valves (momentary toggle).

9. OUTFLOW VALVE POSITION INDICATORS

Indicates the position of each Outflow Valve.

PRESSURIZATION MONITORS



1. CABIN VERTICAL SPEED INDICATOR

2. CABIN ALTITUDE INDICATOR

Displays Cabin Altitude with a Sweep Hand and Digital Counter. The Counter moves in 1000 foot increments.

3. BARO SET KNOB

Readout is in inches of mercury and is maintained at 29.92.

4. CABIN DIFFERENTIAL PRESSURE INDICATOR

Displays Differential Pressure between cabin and ambient. Normal maximum in the Automatic Mode is 8.9 psi.

5. PRESSURE RELIEF VALVE OPEN LIGHTS (Amber)

Illuminates when the corresponding Pressure Relief Valve opens at 9.25 or 9.75 psi.

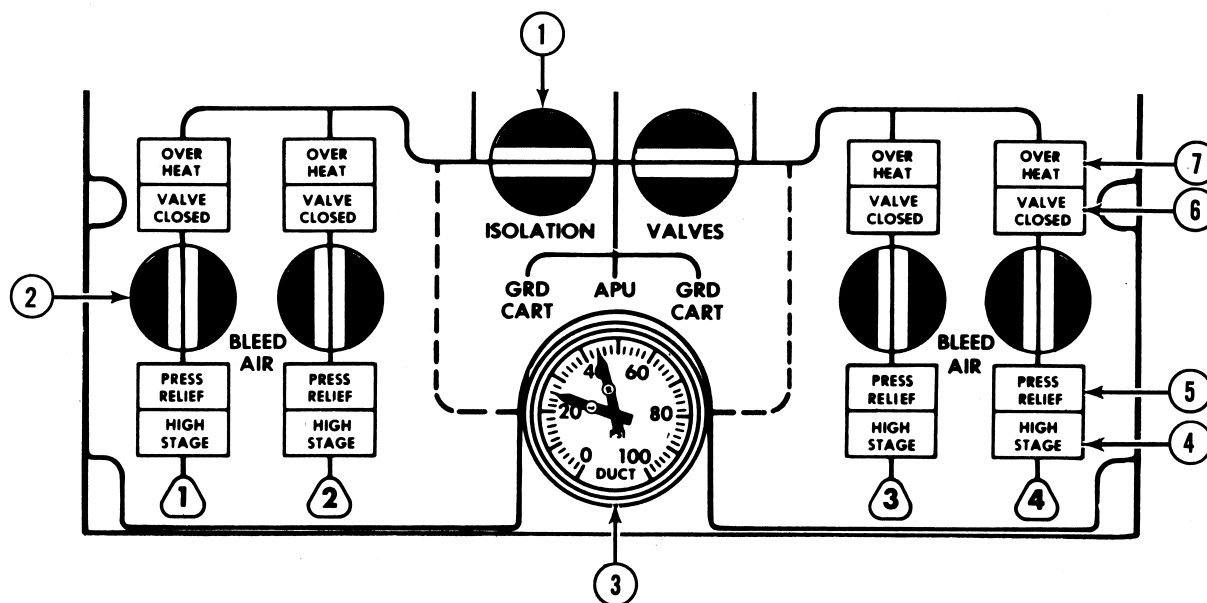
6. AUTO FAIL WARNING LIGHT (Amber)

Illuminates to indicate failure of the Automatic Pressurization Control System. The light extinguishes when the pressurization mode switch is placed to MAN.

7. ALTITUDE WARNING HORN CUTOUT SWITCH

Pressing the switch will silence the Altitude Warning System. It will reset descending through 9,500 feet cabin altitude.

PNEUMATIC CONTROLS



1. DUCT ISOLATION VALVE SWITCHES

Isolates the Wing Ducts from the system. Normally the valves are open.

2. BLEED AIR VALVE SWITCHES

Controls Engine Bleed Air to the Pneumatic Duct. The OPEN position allows the valve to open pneumatically and the High Stage valve to open. The valve is a Pressure Control and Back-up Temperature Control along with being a Reverse Flow Check Valve. The reverse flow feature is overridden by the Engine Ignition Switch when placed to GND START to provide reverse air flow for Engine Starter Turbine operation. The CLOSED position energizes solenoids to pneumatically close the Bleed Valve and High Stage Valve. The Engine Fire Switch, when pulled, will override the OPEN position to close the Bleed Air Valve only.

3. DUCT PRESSURE INDICATOR

Displays the Duct Pressure in the left and right Wing Ducts.

4. HIGH STAGE LIGHTS (Green)

Illuminates when the High Stage Bleed Valve has opened to provide required high stage air during low thrust operation.

5. PRESSURE RELIEF LIGHTS (Amber)

Indicates excessive bleed air pressure upstream of the Bleed Air Valve and the Relief Valve is venting bleed air into the cowl area to prevent damage to the Precooler and Engine Ducts.

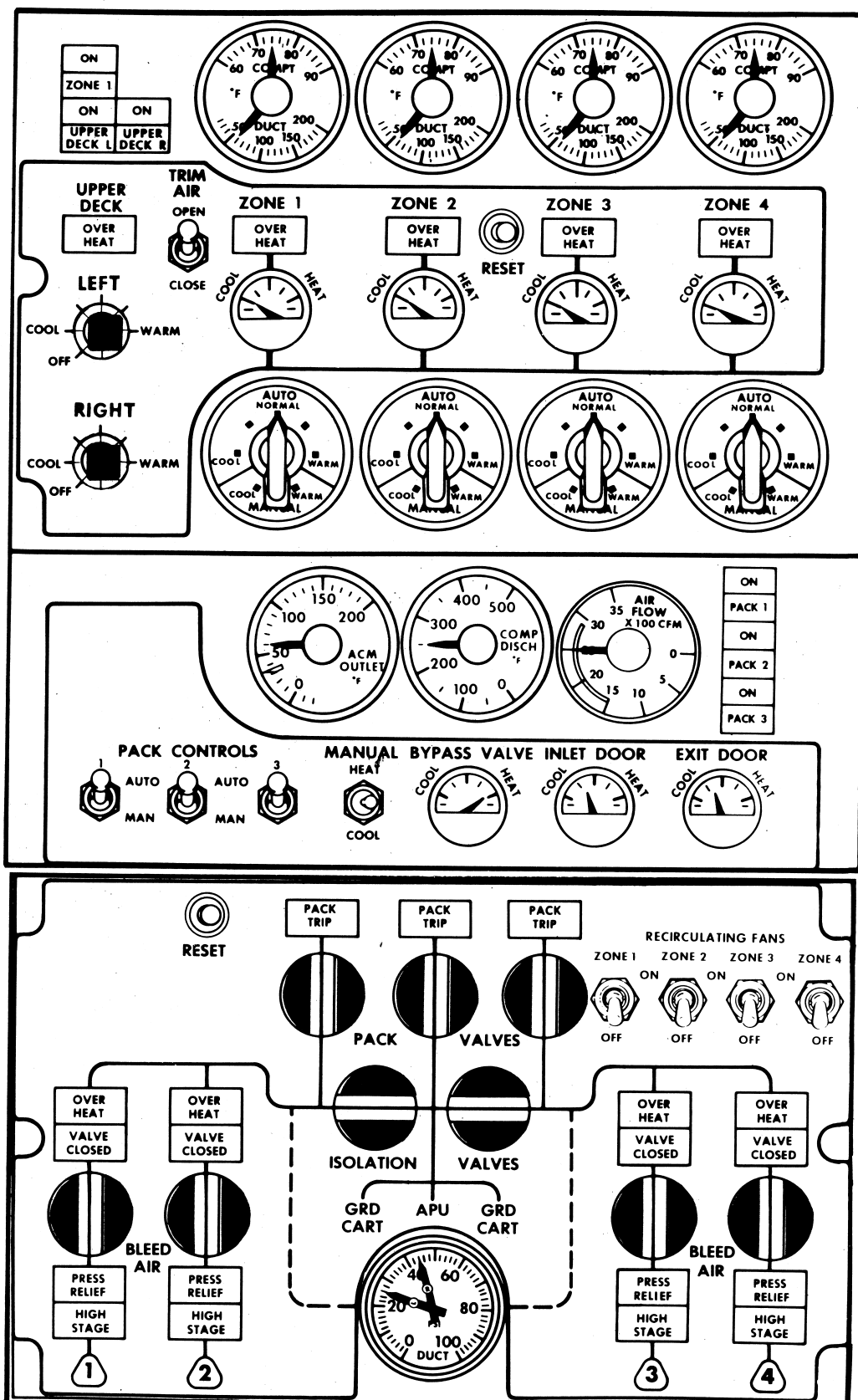
6. BLEED AIR VALVE CLOSED LIGHTS (Amber)

Illuminated whenever the Engine Bleed Air Valve is fully closed.

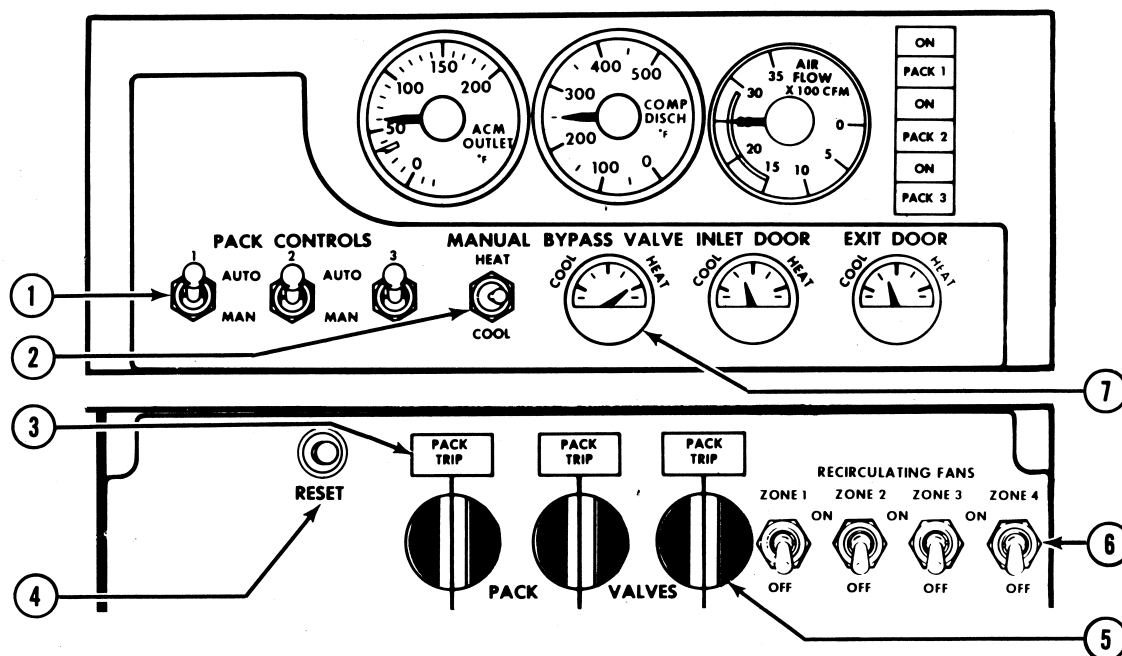
7. BLEED AIR OVERHEAT LIGHTS (Amber)

Illuminates if the temperature of bleed air is excessive downstream of the Bleed Air Valve and Precooler.

AIR CONDITIONING



PACK CONTROLS & INDICATION



1. PACK CONTROL SWITCHES

Provides for Automatic or Manual control of the Air Conditioning Packs. Normal operation is in the AUTO position. When placed to the MANUAL position, the Exit Door is driven to full cool. The position of the Bypass Valve and Inlet Door is controlled manually to modulate ACM outlet temperature.

2. MANUAL TEMPERATURE SWITCH

Switch is spring loaded to the center position. Controls the Bypass Valve and Inlet Door of any pack with its Pack Control Switch in MAN, and Pack Selector Switch pressed.

3. PACK TRIP LIGHTS (Amber)

Indicates automatic closure of the pack valve due to: high ACM OUTLET temperature, High COMP DISCH temperature and out of sequence position of the Bypass Valve in relation to the position of the Inlet and Exit Doors.

4. PACK TRIP RESET SWITCH

Pressing the switch following a pack trip will extinguish the Pack Trip light and reopen the Pack Valve, allowing the pack to restart, provided pack temperature has dropped below pack trip level and/or the doors have been re-positioned.

5. PACK VALVE SWITCHES

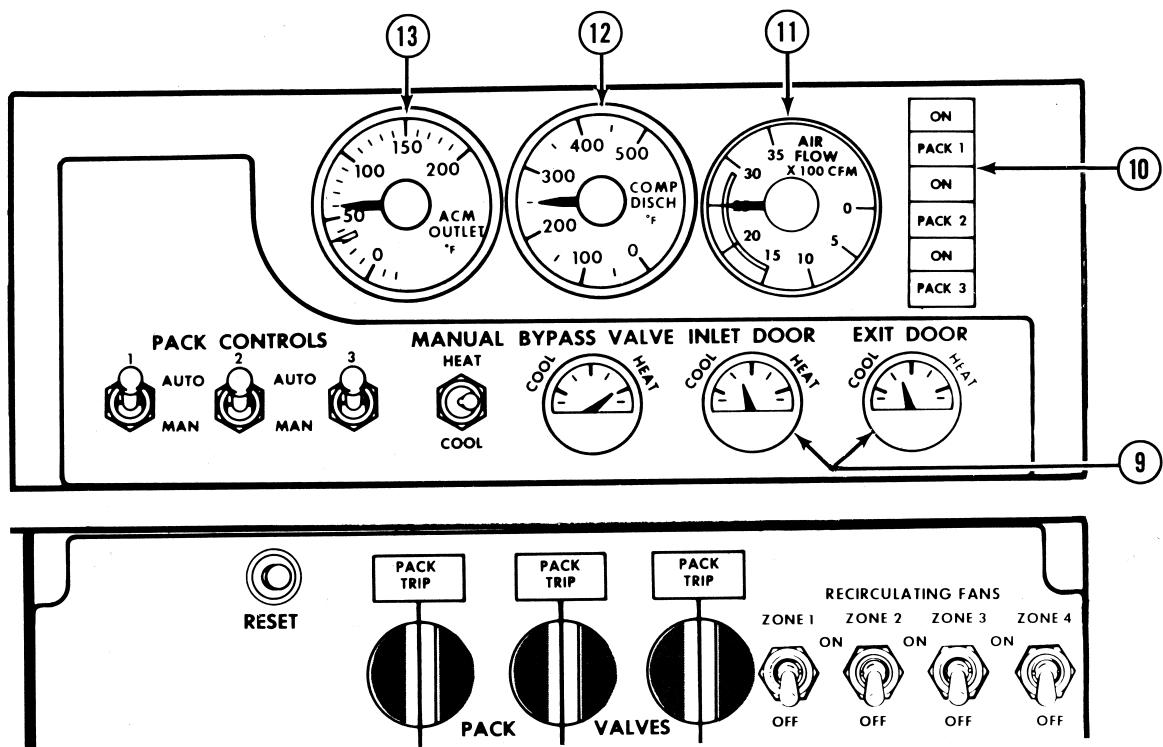
The OPEN position allows and regulates airflow from the Pneumatic Duct to the Air Conditioning Pack. Electrical power is required to close the valves with the switch in the CLOSED position.

6. RECIRCULATING FAN SWITCHES

Recirculates the conditioned air. No. 1 switch is for the cockpit, No.'s 2, 3 and 4 are for the cabin.

7. TURBINE BYPASS VALVE POSITION INDICATOR

Reflects the demand on the pack for cooling. On the ground it reflects total temperature control. In flight, the valve moves in conjunction with the Inlet and Exit doors.



9. INLET AND EXIT DOOR POSITION INDICATORS

In flight temperature control is provided primarily by these doors. In AUTO operation on the ground, both doors will indicate full open.

10. PACK SELECTOR SWITCHES

Selects the pack to be monitored by all six indicators and permits manual pack control when a pack controls switch is in MAN. A white light illuminates in the pressed switch.

11. PACK AIRFLOW INDICATOR

Indicates airflow through a selected pack.

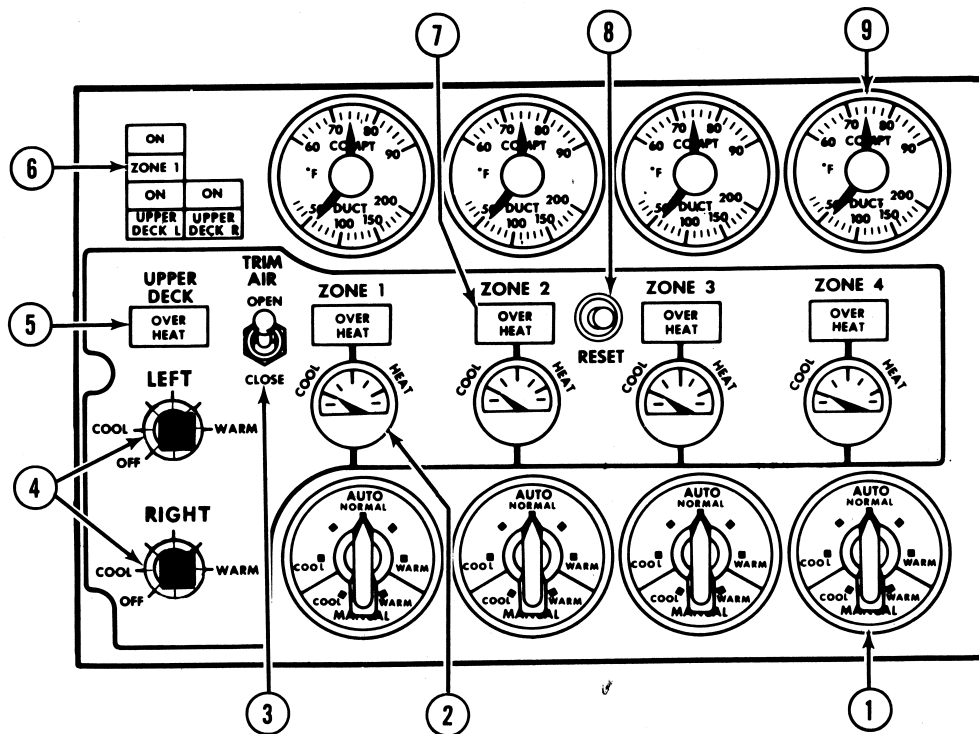
12. COMPRESSOR DISCHARGE TEMPERATURE INDICATOR

Indicates temperature downstream of the compressor or check valve and prior to the secondary heat exchanger.

13. AIR CYCLE MACHINE OUTLET TEMPERATURE INDICATOR

Indicates Pack Outlet Temperature to the Conditioned Air Manifold downstream of the Water Separator.

ZONE AND UPPER DECK TEMPERATURE CONTROL



1. ZONE TEMPERATURE SELECTOR SWITCHES

Controls the temperature automatically or manually in each of four zones. The zone that requires the coldest air controls the temperature output of all packs when selectors are in AUTO range.

2. TRIM AIR INDICATORS

Displays the relative positions of the Trim Air Valves which are controlled by the automatic/manual Zone Temperature Switches. The indicator that is in the coolest position indicates which controller is providing signals to the pack controllers in automatic control.

3. TRIM AIR SWITCH

Supplies hot trim air to the Trim Air Valves when in the OPEN position. When CLOSED, all trim air is shut off.

4. UPPER DECK TEMPERATURE SWITCHES

Provides thermostatic control of electric heating for the upper deck.

5. UPPER DECK OVERHEAT LIGHT (Amber)

Illuminates to indicate an overheat in either Upper Deck Duct or either Heater Element, and when the electric heater has tripped off.

6. ZONE 1 AND UPPER DECK L & R SELECTOR SWITCHES

Pressing selects Zone 1 or Upper Deck area for temperature readouts on the time shared Zone 1 indicator. A white ON light illuminates in the switch to indicate which area is selected.

7. ZONE OVERHEAT LIGHTS (Amber)

Illuminates when a duct overheat (185°) occurs. When Zone Temp Selector is in AUTO, the Trim Air Valve will move to the full COOL position. In manual it provides a warning only.

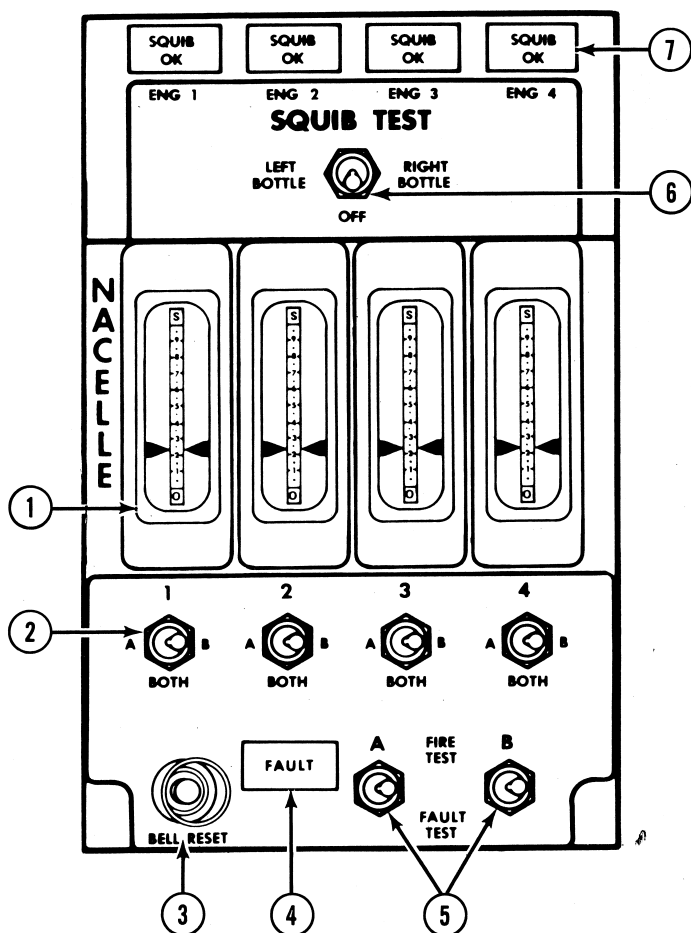
8. ZONE OVERHEAT RESET SWITCH

Pushing resets auto control and extinguishes the light when the duct temperature is below 160°. It may be utilized to reset the Upper Deck Heaters.

9. ZONE COMPARTMENT/DUCT TEMPERATURE INDICATORS

Maintains a continuous temperature readout for Zones 2, 3 and 4.

NACELLE FIRE DETECTION



1. NACELLE TEMPERATURE INDICATORS

Indicates relative temperature levels in the Engine Nacelle area. Normal indications are in the green band (lower portion of the scale), overheat in the amber band (mid range) and fire in the red band (upper range). A short in a Fire Detection Loop will cause a full deflection to the upper end of the scale. An open circuit will be indicated by deflection to the bottom of the scale when making a fire or fault test.

2. NACELLE FIRE DETECTOR SWITCHES

Selects the loop desired in each nacelle to provide fire warnings. Three positions are available: A, B or BOTH. Normally BOTH is selected unless failure of one loop dictates use of the good loop.

3. FIRE BELL RESET

Pressing extinguishes the Master Fire Warning Lights, silences the Fire Warning Bell and resets the warning circuits.

4. NACELLE FIRE DETECTOR FAULT LIGHT (Amber)

Illuminates to indicate a detection fault (short) or a fire signal from one loop when the Nacelle Fire Detector switch is in the BOTH position. It will illuminate during a fault test to indicate the detector is operational.

5. NACELLE FIRE/FAULT TEST SWITCHES

The test switches are momentarily held to the TEST position in single loop operation. When the fire detection switches are in BOTH, the switches must both be held with one switch in FIRE TEST and the other in FAULT TEST to give a valid check of the fire detection circuits. When this is accomplished, the FAULT light and FIRE DETECTION light on the Pilots Annunciator Panel will illuminate along with the Master Fire and Engine Fire Warning Lights. The Fire Warning Bell will also sound.

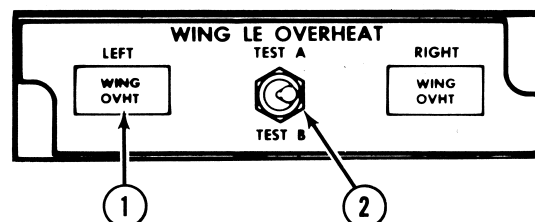
6. SQUIB TEST SWITCH

Selects the bottles for the Squib Test by holding momentarily to the left or right.

7. SQUIB LIGHTS (Green)

Illuminates to indicate the Extinguisher Circuit is operative.

WING LEADING EDGE OVERHEAT



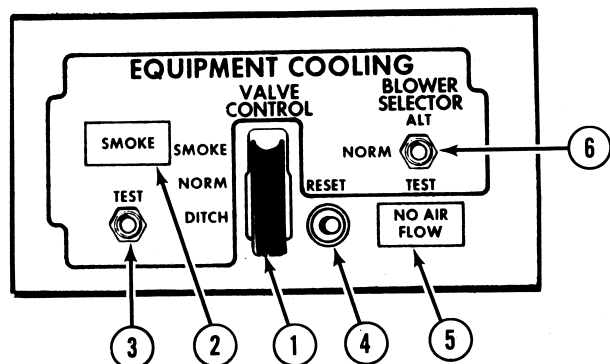
1. WING OVERHEAT LIGHTS (Amber)

Illumination indicates leakage/rupture in the Pneumatic Wing Duct or in the Engine Strut. Both lights will illuminate during testing.

2. WING OVERHEAT TEST SWITCH

Holding momentarily to the A position checks electrical continuity to the detectors, and in B position, checks continuity from the detectors.

EQUIPMENT COOLING



1. VALVE CONTROL SWITCH

Controls the operation and position of the Flight Deck Equipment Cooling Dump Valve and the Flow Control Valve. In the NORM guarded position, air is discharged overboard and/or ducted into the forward cargo compartment for heating. In SMOKE position, all air is dumped overboard. The DITCH position closes the flow control valve and the Upper Deck Dump Valve to prevent flooding of the Forward Cargo Compartment during ditching.

2. SMOKE DETECTOR LIGHT (Amber)

Illuminates when smoke is detected in the Flight Deck or Main Equipment Center Cooling System and during TEST. With the light illuminated, the equipment cooling system automatically switches to the SMOKE mode.

3. SMOKE DETECTION TEST SWITCH

Momentarily holding the switch to TEST, checks the Smoke Detector System and illuminates the SMOKE light.

4. NO AIRFLOW RESET SWITCH

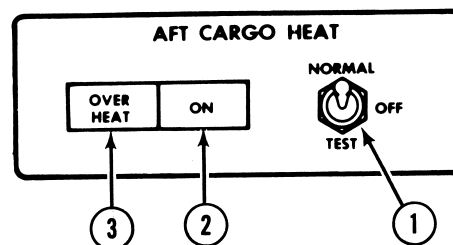
Pressing the switch resets the Equipment Cooling No Airflow Detection System and extinguishes the NO AIRFLOW light.

5. NO AIRFLOW LIGHT (Amber)

Illuminates to indicate the loss of normal airflow in the Equipment Cooling System. The Ground Crew Horn will also sound (ground only). All other functions are identical to the Smoke Detection System.

6. BLOWER SELECTOR SWITCH

NORM and ALT positions select either of two Main Equipment Center Blowers. The Flight Deck Fan operates continuously. The TEST position allows for maintenance ground testing of the No Airflow Detection System.



1. AFT CARGO HEAT SWITCH

The NORMAL position allows heating. The OFF position shuts off the heated air supply. The TEST position checks that heated air can be supplied to the aft cargo compartment and will illuminate the ON light.

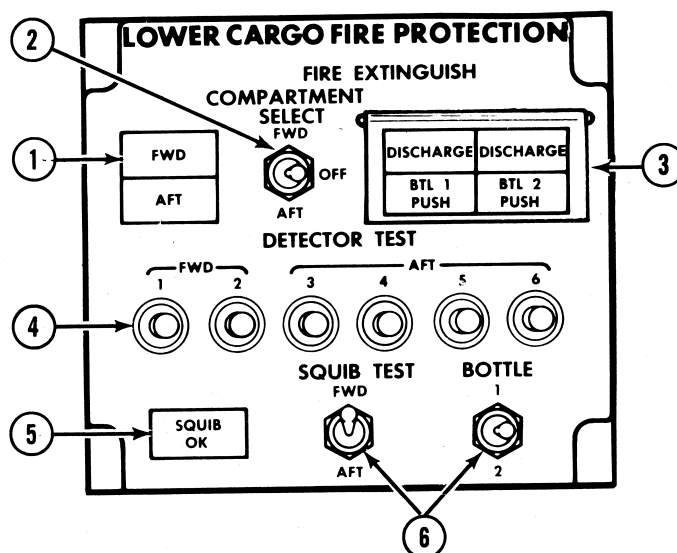
2. AFT CARGO HEAT ON LIGHT (Green)

Illuminates to indicate heated air is flowing into the Aft Cargo Compartment. The light cycles on and off while maintaining normal temperatures.

3. AFT CARGO OVERHEAT LIGHT (Amber)

Illuminates to indicate an overheat in the Aft Cargo Compartment.

LOWER CARGO COMPARTMENT FIRE PROTECTION



1. LOWER CARGO FIRE WARNING LIGHTS (Red)

Illuminates for a smoke condition in the FWD or AFT Cargo Compartment. When illuminated, the Master Fire Warning and Cargo Fire Warning lights illuminate, and the Warning Bell will sound. The light remains illuminated as long as a smoke condition exists.

2. LOWER CARGO COMPARTMENT SELECT SWITCH

Selects the cargo compartment for extinguisher discharge. The FWD position will cause the Equipment Cooling system to drive to the SMOKE mode. The AFT position shuts off aft cargo heat.

3. LOWER CARGO EXTINGUISHER DISCHARGE SWITCHES (Amber)

Pressing the switches discharges the fire bottles into the selected compartment and illuminates the light in the switch (amber) indicating it has discharged. The light for BTL 1 will illuminate if a thermal discharge of either bottle occurs.

4. LOWER CARGO DETECTOR TEST SWITCHES

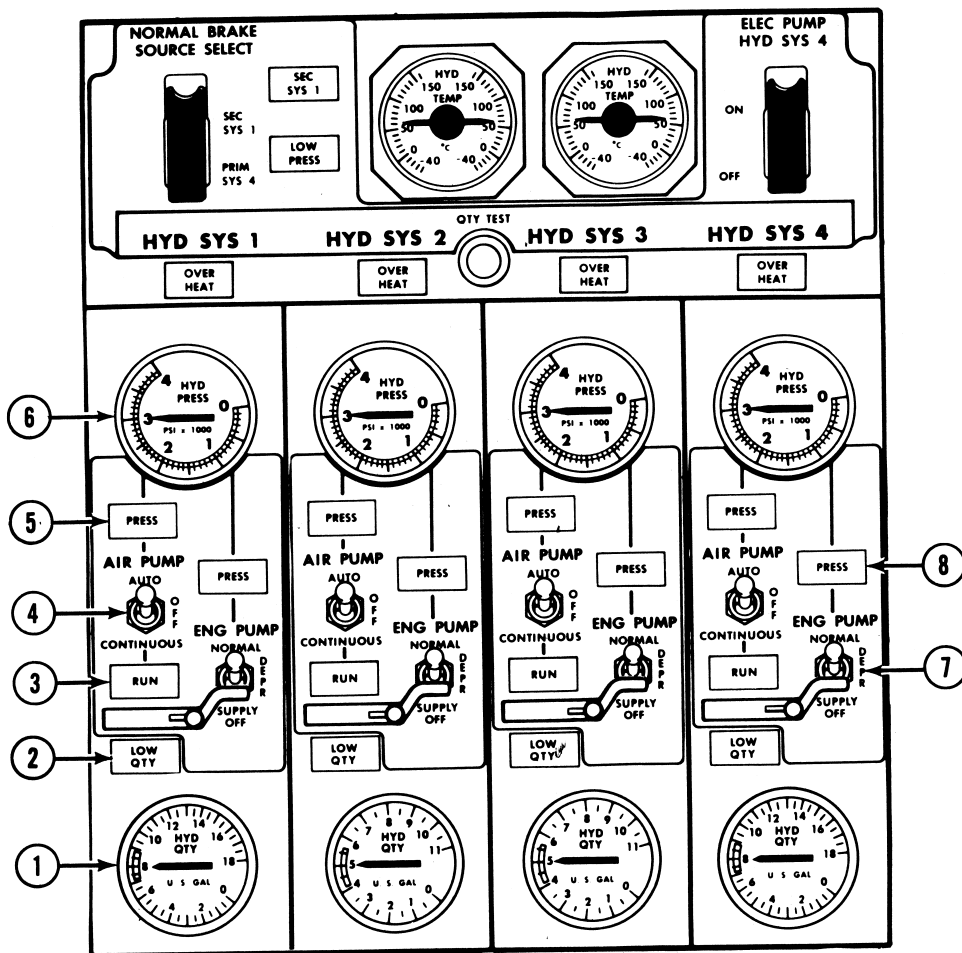
Pressing, simulates a fire condition at individual Fire (Smoke) Detectors.

5. LOWER CARGO SQUIB TEST LIGHT (Green)

Illuminates during the Squib Test if the Extinguisher Squibs are operational.

6. LOWER CARGO SQUIB TEST SWITCHES

Momentarily holding the BTL 1 or BTL 2 position tests the FWD or AFT squib on the extinguisher bottles.



1. HYDRAULIC QUANTITY INDICATORS

2. HYDRAULIC LOW QUANTITY LIGHTS (Amber)

Illuminated when the indicated hydraulic quantity is low and the indication is at approximately the 6 o'clock position.

3. AIR DRIVEN HYDRAULIC PUMP RUN LIGHTS (Blue)

Illuminated when the ADP Air Valve is open.

4. AIR DRIVEN HYDRAULIC PUMP SWITCHES

In the OFF position pneumatic air is shut off to the pump. The AUTO position allows the pump to operate when the EDP output is below the green band. The CONTINUOUS position allows the pump to operate continuously.

5. AIR DRIVEN HYDRAULIC PUMP LOW PRESSURE LIGHTS (Amber)

Illuminates any time the switch is OFF or the ADP is operating and pressure is low.

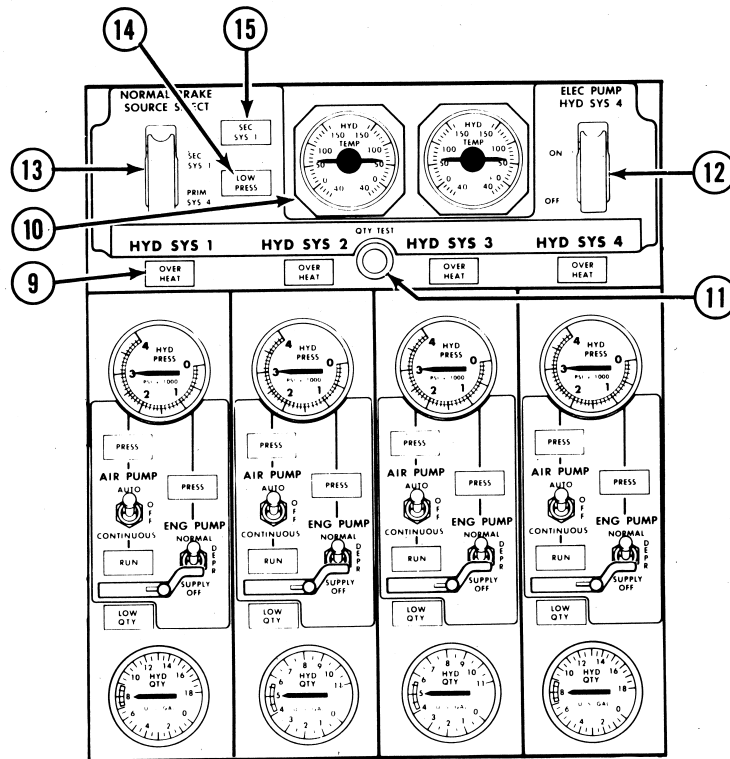
6. HYDRAULIC PRESSURE INDICATOR

7. ENGINE DRIVEN HYDRAULIC PUMP SWITCH

The NORMAL position allows operation of the EDP when the engine is operating. The DEPR position depressurizes the pump while allowing flow of hydraulic fluid to the pump for lubrication and cooling. The SUPPLY OFF position depressurizes the pump and closes the Fluid Supply Valve.

8. ENGINE DRIVEN HYDRAULIC PUMP LOW PRESSURE LIGHTS (Amber)

Illuminated when the EDP Pump output is low.



9. HYDRAULIC SYSTEM OVERHEAT LIGHTS (Amber)

Illuminates to indicate excessive hydraulic fluid temperatures.

10. HYDRAULIC TEMPERATURE INDICATORS

Indicates the Hydraulic System temperatures at the Case Drain Module.

11. HYDRAULIC QUANTITY TEST SWITCH

When pressed, all quantity indications run toward zero and return to the initial reading when released.

12. HYDRAULIC SYSTEM 4 ELECTRIC PUMP SWITCH

The switch is guarded to OFF and may be positioned to the ON position for pressurizing the No. 4 Hydraulic System. The pump will only operate with the Ground Handling Bus power and on some airplanes will trip to OFF when the No. 4 system is pressurized with the ADP or EDP.

13. NORMAL BRAKE SOURCE SELECT SWITCH

Selects the Hydraulic System Source for the Normal Brake System. The switch is guarded to "PRIM SYS 4".

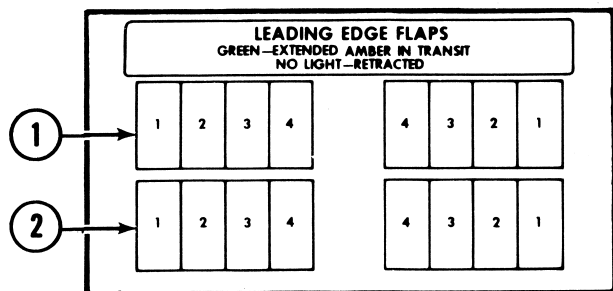
14. BRAKE LOW PRESSURE LIGHT (Amber)

Illuminated when the selected brake system hydraulic pressure is low. It will remain illuminated if system 4 is selected and the Electric Pump is pressurizing the hydraulic system.

15. HYDRAULIC SYSTEM 1 SELECT LIGHT (Green)

Illuminated when the Hydraulic System 1 is selected to pressurize the Brake System.

LEADING EDGE FLAP INDICATOR



1. LEADING EDGE IN TRANSIT LIGHTS (Amber)

Illuminates when the Leading Edge Flaps are in transit.

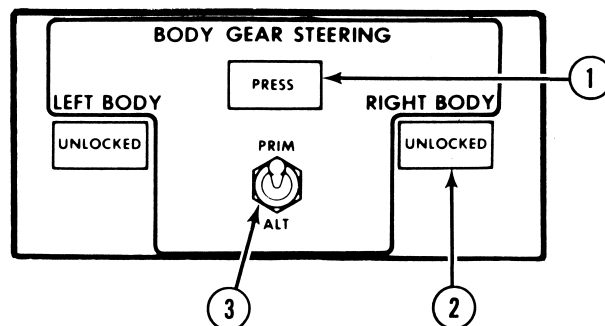
2. LEADING EDGE EXTENDED LIGHTS (Green)

Illuminate when the Leading Edge Flaps are fully extended.

NOTE:

All lights will be extinguished when LE flaps are retracted.

BODY GEAR STEERING



1. BODY GEAR STEERING PRESSURE LIGHT (Amber)

Illuminates when hydraulic pressure is available to the Body Gear Steering System.

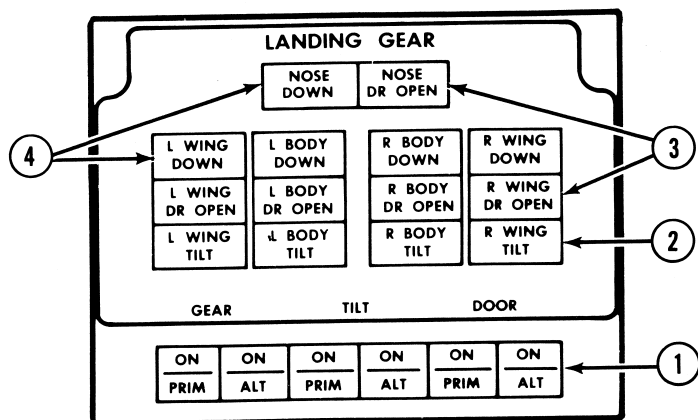
2. BODY GEAR STEERING UNLOCKED LIGHTS (Amber)

Indicates an unlocked condition for the selected PRIM or ALT Steering Actuator Locked Sensors.

3. BODY GEAR STEERING PRIM/ALT SWITCH

Selects PRIM or ALT sensors for unlocked light indications.

LANDING GEAR ANNUNCIATOR PANEL



1. PRIMARY/ALTERNATE ANNUNCIATOR SWITCHES

Press and hold switches select the Primary or Alternate Sensors to be checked. The Annunciator Lights will respond giving the appropriate light indications. A white light illuminates in each switch as it is pressed.

2. TILT ANNUNCIATOR LIGHTS (Amber)

Illuminate when pressed with the Wing or Body Gear(s) in a not tilted position.

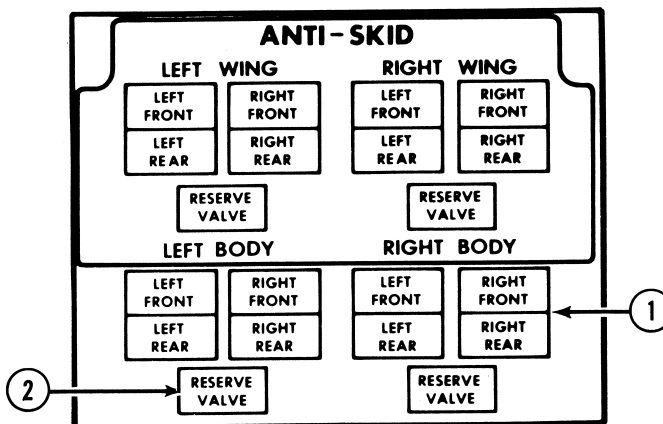
3. DOOR ANNUNCIATOR LIGHTS (Amber)

Illuminates when pressed with the Gear Door(s) open.

4. GEAR DOWN ANNUNCIATION LIGHTS (Green)

Illuminates when pressed with the gear down and locked.

ANTI-SKID ANNUNCIATOR PANEL



1. ANTI-SKID ANNUNCIATOR LIGHTS (16) (Amber)

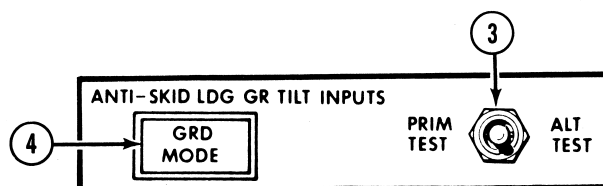
Illuminates to indicate an Anti-skid Electrical Failure for the indicated wheel.

2. RESERVE VALVE ANNUNCIATOR LIGHTS (4) (Amber)

Illuminate to indicate an electrical failure in a Reserve Anti-skid Valve.

NOTE:

All Anti-skid Lights illuminate when the Anti-skid Switch is turned OFF.



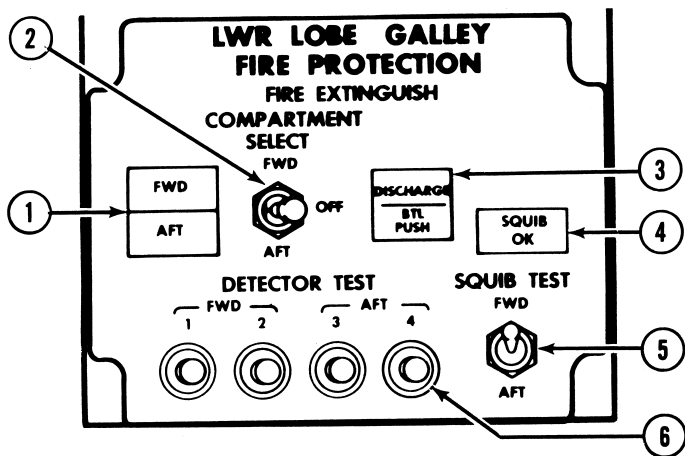
3. ANTI-SKID TILT INPUT TEST SWITCH

PRIM TEST and ALT TEST positions test Landing Gear Tilt Inputs to the Anti-skid Control Unit.

4. GROUND MODE ANNUNCIATOR LIGHT (Green)

Illuminates during the Anti-skid Landing Gear Tilt Inputs Test if the test is valid.

LOWER LOBE GALLEY FIRE PROTECTION



1. LOWER LOBE GALLEY FIRE WARNING LIGHTS (Red)

Illuminates for a fire condition in the indicated Galley Compartment and during fire test. The light will remain illuminated as long as a smoke condition exists.

2. LOWER LOBE GALLEY COMPARTMENT SELECT SWITCH

Selects the galley for the extinguisher discharge and turns off the ventilating air to both galleys, stops operation of the Galley/Lav Fan and closes the Galley/Lav Vent valve if open.

3. LOWER LOBE GALLEY EXTINGUISHER DISCHARGE SWITCH (Amber)

Pressing discharges the Fire Extinguisher into the selected compartment, and when discharged the light in the switch will illuminate.

4. LOWER LOBE GALLEY SQUIB TEST (Green)

Illuminates when testing the Squibs.

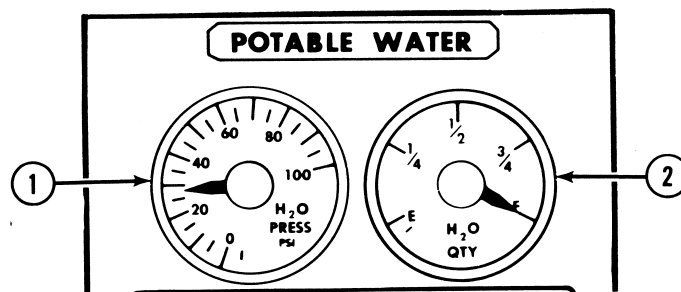
5. LOWER LOBE GALLEY SQUIB TEST SWITCH

Momentarily holding to FWD or AFT tests the Squib for the Extinguisher Bottle.

6. LOWER LOBE GALLEY DETECTOR TEST SWITCHES

Pressing, simulates a fire condition at each individual detection. Illuminates the respective Lower Lobe Galley Fire Warning Light, Pilot's Lower Lobe Galley and Master Fire Warning Lights, and sounds the Fire Warning Bell.

POTABLE WATER

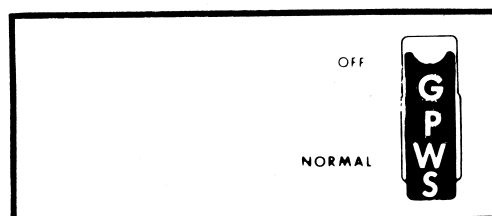


1. WATER PRESSURE INDICATOR

Indicates Potable Water Tank pressure.

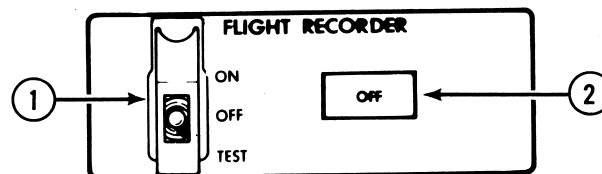
2. WATER QUANTITY INDICATOR

GROUND PROXIMITY WARNING SYSTEM SWITCH



The guarded switch is safetied in the NORM position. The entire system may be deactivated by placing the switch to the OFF position.

FLIGHT RECORDER



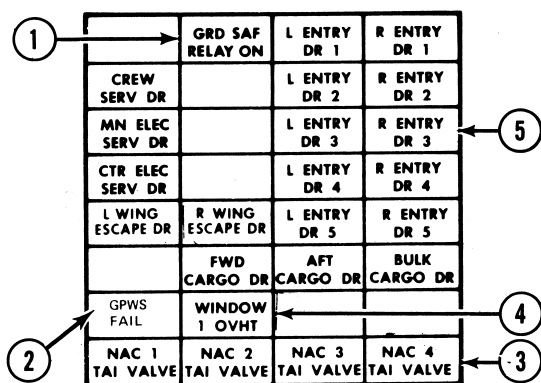
1. FLIGHT RECORDER SWITCH

The switch is guarded to OFF but may be momentarily held to the spring loaded TEST position. In the OFF position, the recorder will operate normally when powered by the airplane generators. The ON position is normally a maintenance position.

2. OFF LIGHT (Amber)

Illuminates when the recorder is not running or a fault exists. The light will extinguish when operating on APU or external power when the switch is held in the TEST position.

FLIGHT ENGINEER ANNUNCIATOR PANEL



1. GROUND SAFETY RELAY LIGHT (Green)

Illuminates when the Main Landing Gear tilt is in the Ground Mode or the Nose Gear PRIM and ALT not in agreement.

2. GPWS FAIL LIGHT (Amber)

Illuminates steady with a failure of the computer and will not extinguish when placing the GPWS switch to OFF. It flashes indicating an invalid signal input and will extinguish when the switch is placed to OFF.

3. NACELLE ANTI-ICE OVERPRESSURE LIGHTS (Amber)

Indicates the Nacelle Anti-ice Valve has failed to regulate pressure to within the prescribed limits.

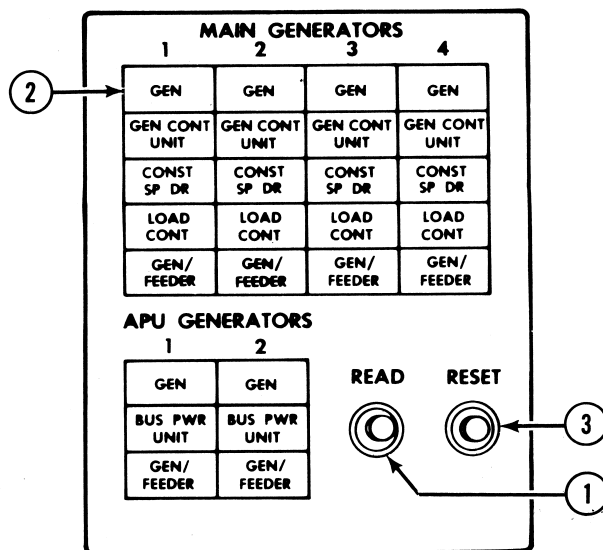
4. NO. 1 WINDOW OVERHEAT LIGHT (Amber)

Illuminates when either the Captain's or F/O's No. 1 window has an overheat condition. Switching the affected window heat OFF will extinguish the light and reset the Warning System.

5. DOOR ANNUNCIATOR LIGHTS (Amber)

Illuminates when the respective doors are not closed and latched.

MAIN/APU GENERATOR FAULT ANNUNCIATOR



1. ANNUNCIATOR READ SWITCH

Pressing, will allow a readout on the Annunciator. If any fault has occurred, the respective light will illuminate.

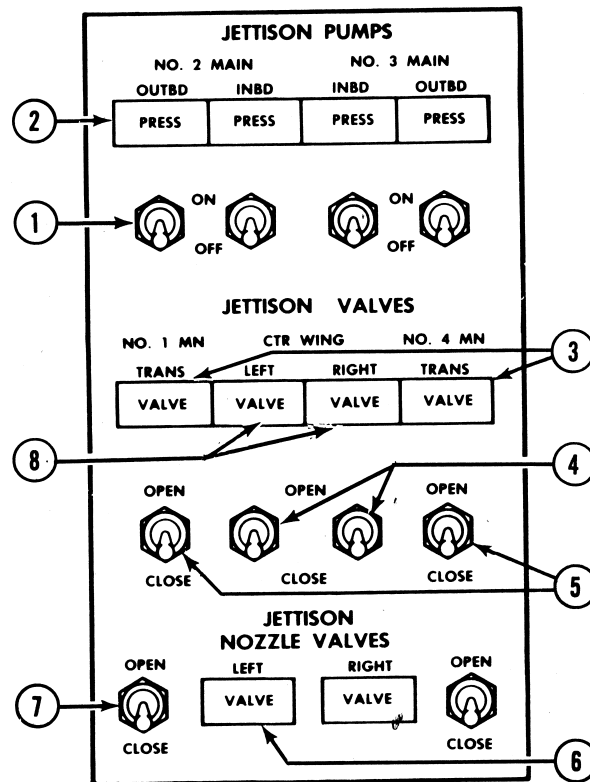
2. ANNUNCIATOR LIGHTS (Amber)

Illuminates to indicate engine or APU Generator Fault.

3. ANNUNCIATOR RESET SWITCH

Pressing both the READ and RESET switch simultaneously will reset the Annunciator Panel and extinguish the Fault Light after the system is cleared of the fault.

FUEL JETTISON



NOTE:

A red door covers the Fuel Jettison Panel. Blocks on the inside of the door prohibit closing the door when any Fuel Jettison Switches are in the OPEN or ON position.

1. JETTISON PUMP SWITCHES

Turns ON Jettison Pumps in No. 2 and 3 Main Tanks.

2. JETTISON PUMP LOW PRESSURE LIGHTS (Amber)

Lights are inoperative when the switches are OFF. Illuminates when the pump switches are ON and the fuel in the tank goes below standpipe level.

3. JETTISON TRANSFER VALVE LIGHTS (Blue)

Illuminate when the valve is in transit.

4. CENTER WING JETTISON VALVE SWITCHES

The OPEN position connects the Center Wing Tank to the Jettison Manifold.

5. JETTISON TRANSFER VALVE SWITCHES

The OPEN position opens the Transfer Valve for gravity flow from the Main Tanks No. 1 and 4 to Main Tanks No. 2 and 3.

6. JETTISON NOZZLE VALVE LIGHTS (Blue)

Illuminates when the valve is in transit.

7. JETTISON NOZZLE VALVE SWITCHES

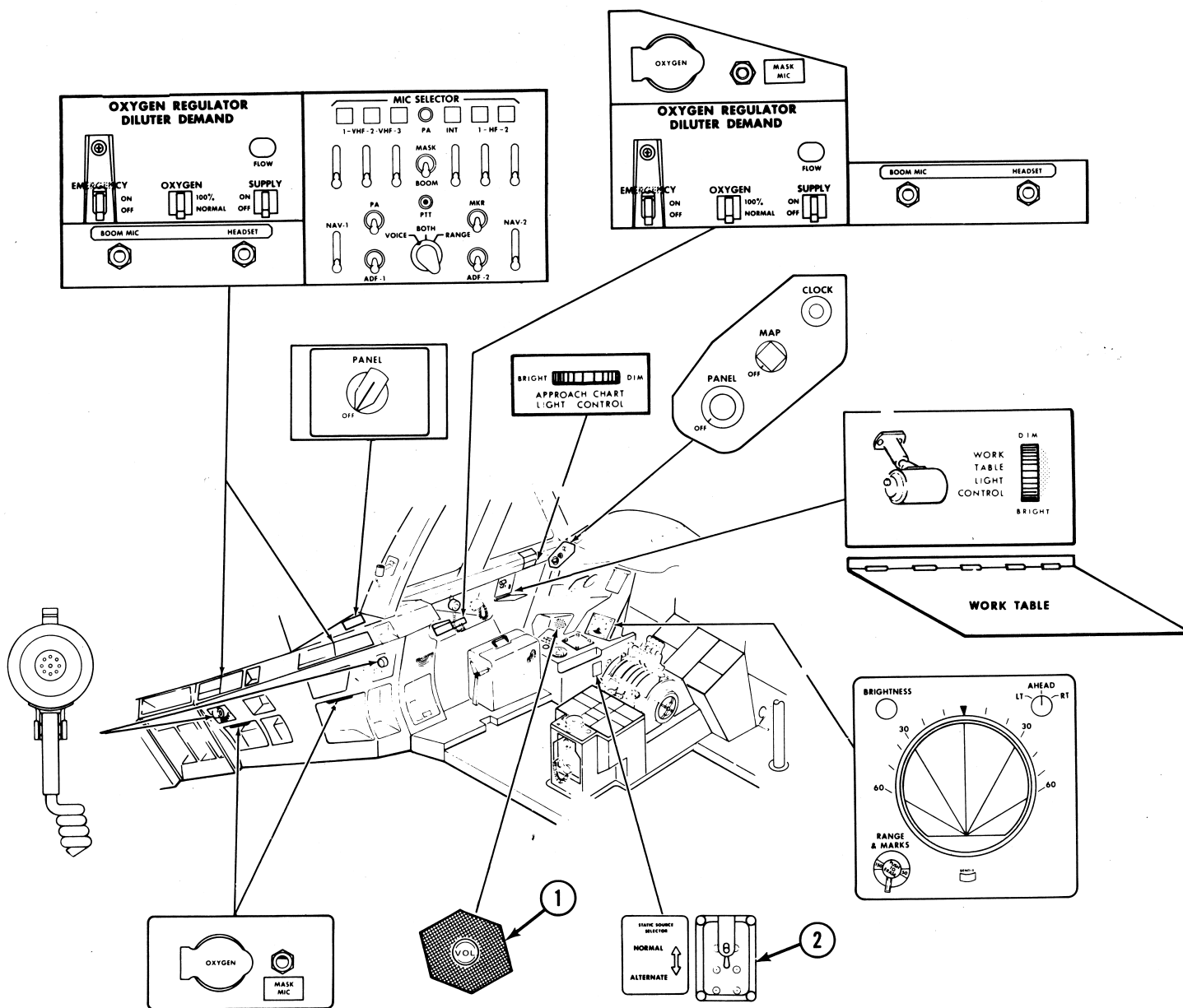
The OPEN position allows fuel jettison from the Wing Tip Nozzles.

8. CENTER WING JETTISON VALVE LIGHTS (Blue)

Illuminates when the valve is in transit.

MISCELLANEOUS

CAPTAIN'S AUXILIARY & OBSERVERS PANEL

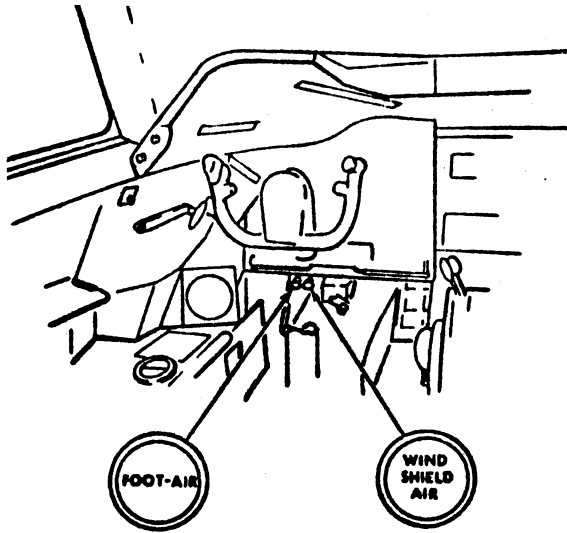


NOTE:

The illustrated equipment and its location are self explanatory except where otherwise noted. The F/O's panels are identical to the Captain's.

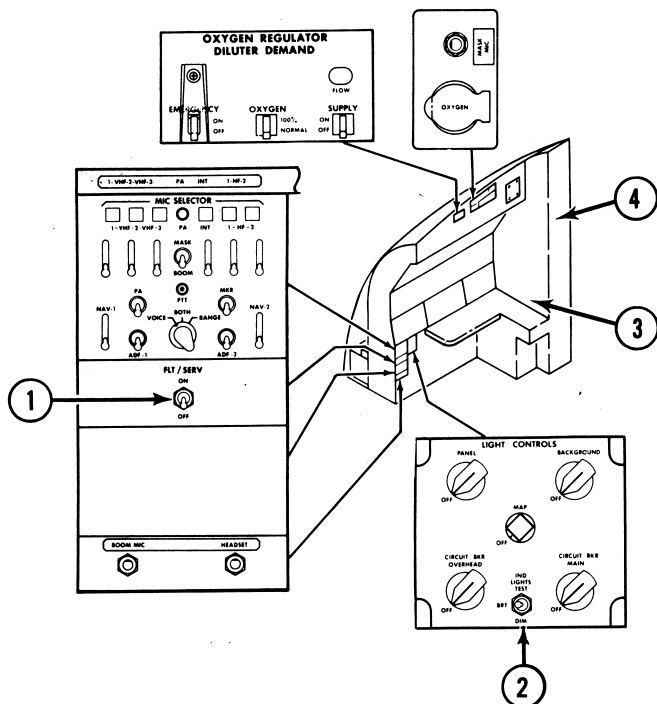
1. SPEAKER WITH ON/OFF VOLUME CONTROL
2. STATIC SOURCE SELECTOR

FOOT AIR & WINDSHIELD AIR CONTROLS



Applies conditioned air around the pilot's rudder pedals and to the pilot's No. 1 windows. The F/O's controls are identical to the Captain's.

FLIGHT ENGINEER'S AUXILIARY PANELS



NOTE:

The illustrated equipment and its location are self explanatory except where otherwise noted.

1. FLIGHT / SERVICE INTERPHONE PARALLELLING SWITCH

Connects the Flight and Service Interphones. When ON, allows crewmembers to communicate with all Ground Service Stations.

2. MASTER INDICATOR LIGHTS DIM AND TEST SWITCH

Momentarily holding the switch to the TEST position illuminates all indicator lights on the F/E's panel. It does not illuminate the function/locator lights. Intensity is set as desired by the DIM or BRIGHT positions.

3. DOME LIGHT SWITCH

Controls the F/E's Aft Cockpit and Storage Area Dome Lights.

4. P-6 INSPECTION LIGHT SWITCH

Controls lighting behind the P-6 Circuit Breaker Panels for viewing through Viewing Ports.

FREIGHTER DIFFERENCES

The American Airlines' 747 freighter is converted from the standard AA passenger configured airplane. Equipment related to the passenger version has been removed while additional equipment for the freighter has been added.

The following has been removed.

PILOT'S OVERHEAD PANEL

1. Evacuation signal panel.
2. Cabin Interphone panel and handset.
3. Lower lobe galley fire warning light.

ENGINEERS PANEL

1. Galley power panel.
2. Galley control panel.
3. Lower lobe galley fire protection panel.
4. Recirculating fan switches 2, 3 and 4.

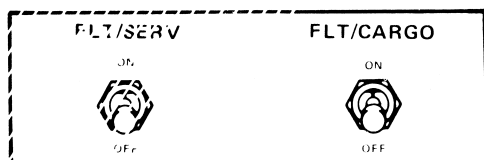
The following equipment, with a brief description, has been installed on the freighter.

PILOT'S OVERHEAD PANEL

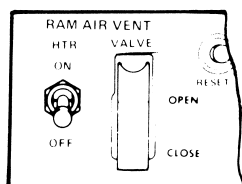
In place of the Lower Lobe Galley Fire Warning Light, a Main Deck Cargo Fire Warning Light has been added.

In place of the FLT DECK DOOR REL a CARGO CREW CALL switch has been added. Pressing, alerts the cargo crew by illuminating a light and sounding a chime.

F/E'S PANEL



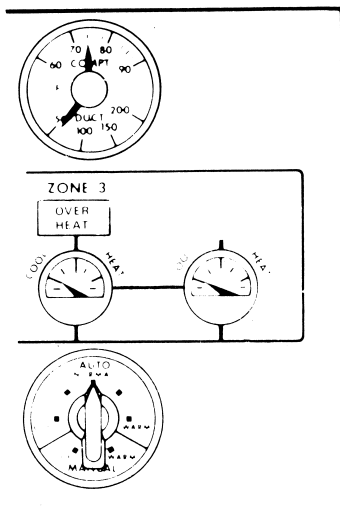
Below the F/E's audio selection panel a FLT/CARGO switch has been added to connect the cargo interphone to the flight interphone.



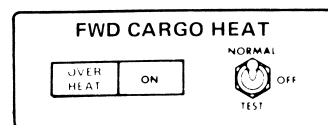
In place of the Gasper Switch, a Ram Air Vent Switch and Ram Air Heater Switch have been added. The guarded Ram Air Switch controls the air inlet just forward of the Pilots. The Heater Switch provides the capability of warming the ram air to automatically control temperatures.



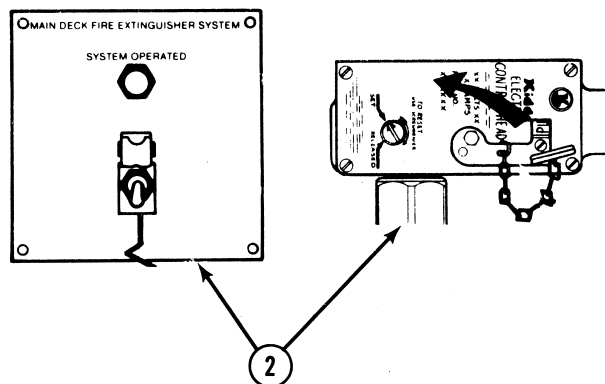
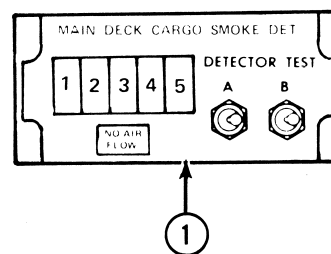
The Zone 1 Recirculating Fan remains but is, labelled Flight Deck Fan.



The air conditioning system zone Temperature Control has been modified. Zone 3 controls left and right Trim Air Valves. The No. 4 Zone Temperature Indicators and controls are inoperative.



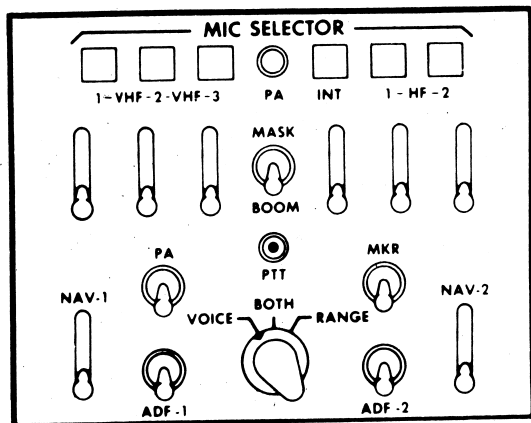
A forward cargo heat system is installed similar to the aft system. The control panel is above the nacelle fire protection panel.



The Main Deck Cargo Smoke Fire Protection Panel (1) is installed in place of the Lower Lobe Galley Fire Protection Panel. Testing and operation of the Main Deck Cargo Smoke Detection System is similar to the Lower Cargo Fire Detection System except a No Airflow Light (amber) illuminates when the vacuum source is insufficient to maintain an adequate airflow through the detectors. The Fire Protection System is discharged manually or electrically from controls on the forward side of the stub partition (2). It can also be discharged manually with a control (2) located adjacent to the fire bottles on the main deck.

	GRD SAF RELAY ON	L ENTRY DR 1	R ENTRY DR 1
CREW SERV DR		DEACTIVATED	DEACTIVATED
MN ELEC SERV DR		DEACTIVATED	DEACTIVATED
CTR ELEC SERV DR		DEACTIVATED	DEACTIVATED
DEACTIVATED	DEACTIVATED	L ENTRY DR 5	R ENTRY DR 5
SHD CARGO DR	FWD CARGO DR	AFT CARGO DR	BULK CARGO DR
GPWS FAIL	WINDOW OVHT		
NAC 1 TAI VALVE	NAC 2 TAI VALVE	NAC 3 TAI VALVE	NAC 4 TAI VALVE

The Flight Engineer's Annunciator Panel reflects changes of the Door Annunciator Lights due to deactivation of several doors.



The PA Monitor switch has been deactivated on all panels.